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**Emeryville	2,000
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Fairfield	800
** Fair Oaks	250
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Folsom	1,500
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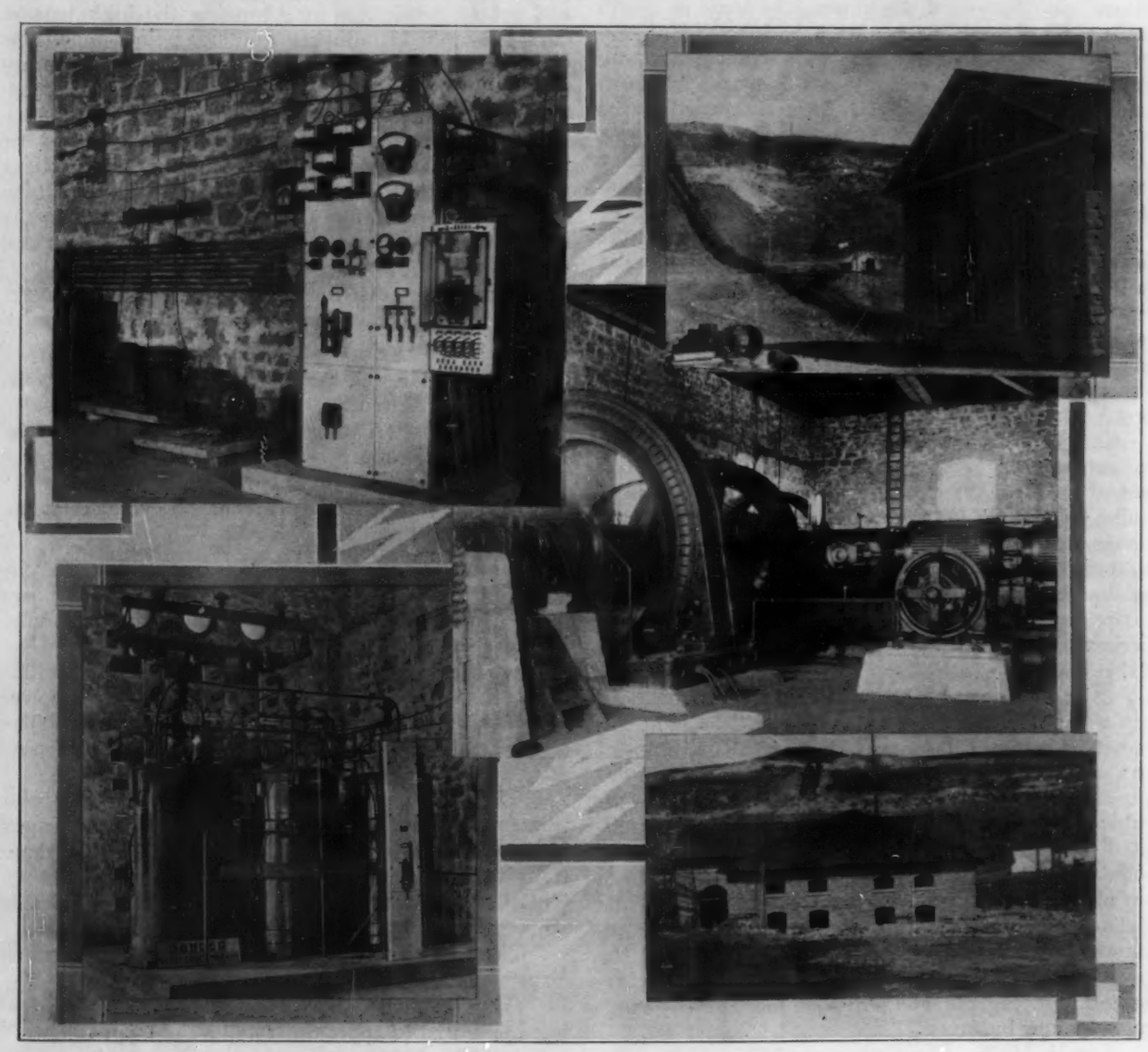
CHANGES IN NORTHWEST POWER COMPANIES



Plant of Yakima-Pasco Power Co. at Naches, Wash.

Important changes in the ownership of public utilities in the Pacific Northwest have taken place during the past few weeks with the result that the Northwestern Corporation which was organized in Portland last year to operate in Walla Walla, Pendleton, Lewiston, North Yakima, Corvallis, Eugene, Independence and several other towns has retired from business in these places and has turned its holdings over to eastern owners. The Strahorne properties in the Yakima Valley have also been sold to eastern people.

The gas and electric plants in Pendleton, Oregon, in Walla Walla, Washington, and the gas plant in

Lewiston, Idaho, together with the hydroelectric plant on the Walla Walla river in Oregon, steam station in Walla Walla and a transmission line about 50 miles long from Walla Walla through Milton, Freewater, Weston, Athena and Adams to Pendleton, all the Walla Walla Valley Railway Company of Portland. They formerly belonged to the Northwestern Corporation.

The street railway system in Walla Walla together with a 15-mile interurban line to Milton and Freewater, Oregon, are now owned and operated by the Walla Walla Railway Company of Portland. They formerly belonged to the Northwestern Corporation.

The gas plant in North Yakima, Washington which also belonged to the corporation, together with the two hydroelectric plants on the Yakima river, transmission lines and distributing systems in North Yakima, Kennewick, Pasco, Mabton, Sunnyside, Granger, Outlook, Kiona, and Richland, steam generating station in Kennewick and city water works in North Yakima, Kennewick and Pasco formerly owned by the two Strahorne companies of Spokane, the Northwest Light & Water Company and the Yakima Valley Power Company have been bought by the Yakima-Pasco Power Company.

The Columbia Power & Light Company, the Yakima-Pasco Power Company and the Walla Walla Valley Railway Company are all owned by the same people who control the Portland Gas & Coke Company and the Astoria Electric Company, and comprise an extensive list of public service properties, said to be the property of the American Power & Light Company of New York.

Guy W. Talbot, formerly vice-president and general manager of the Oregon Electric Railway, is president of the five American power and light local companies, N. A. Weathers is vice-president, Geo. F. Nevins, secretary and treasurer, and L. A. McArthur assistant secretary and treasurer. H. M. Papst is general manager of the Portland Gas & Coke Company; A. S. Grenier, general manager of the Columbia and Yakima companies, and C. S. Walters, general manager of the Walla Walla Valley Railway. Main offices are in Portland. General Manager Grenier has announced that a 66,000 volt line 45 miles long will be built immediately between Pasco and Walla Walla to connect the Columbia and Yakima companies. It has been unofficially announced in Portland that the Astoria, Columbia and Yakima companies will soon be consolidated into one permanent company. Efforts will be made to push the construction of high tension lines into all parts of central Washington and in the Walla Walla-Pendleton territory. The new owners have announced that they are in a position to furnish all the power needed in this section for domestic, manufacturing and pumping use, and will soon inaugurate a campaign for new business.

The H. M. Byllesby Company of Chicago has also opened offices in Portland, having assumed control of the Willamette Valley plants formerly owned by the Northwestern Corporation. Elmer Dover, formerly secretary to Mark Hanna has charge of the Portland office, and MacDonald Spencer, who has been connected with the General Electric Company for several years will be district manager at Eugene.

REPORT OF ELECTRICAL CONDITIONS AT OAKLAND, CALIFORNIA.[1]

BY KEMPSTER B. MILLER.

Electricity supplied to Oakland is derived mainly from the distant hydro-electric plants and high tension transmission lines of the Bay Counties Power Company, the Great Western Power Company and the Standard Electric Company. Current is sometimes supplied from the Martin gas engine plant south of San Francisco, and there is in one of the Oakland substations a large steam turbo-generating unit. All electric power is distributed from two sub-stations at Grove and First streets and on Fifty-first street between Shattuck and Telegraph avenues.

The First street station, which is the principal distributing point for the city, contains the transformers and rotary converters for changing the high tension current supplied from distant outside points to suitable form for city distribution, and also a large steam turbo-electric unit intended as a reserve in case of interruption of the outside supply service or the inadequacy thereof. These two sub-stations are connected by tie feeders, so that each may in a certain measure relieve the other, and from them all of the primary circuits, suppliying current for power, heat and light for the entire area of Oakland and for some outlying districts, radiate.

The primary distribution circuits, leading from the sub-stations to the various portions of the city, are of four different types, as follows:

2300 volt alternating current three-phase, 60 cycle, 4-wire circuits.
4000 volt alternating current three-phase, 60 cycle, 3-wire circuits.
500 volt 2-wire direct current circuits.
7½ amp. alternating current, 60 cycle series arc light circuits.

The 2300 and 4000 volt alternating current circuits are for the general power and lighting purposes of the consumers and also for supplying current for the incandescent lamps in the ornamental posts or electroliers used in the down-town street lighting. The 500 volt direct current circuits are for strictly power purposes principally in the business district. The series arc lighting circuits are solely for the purpose of supplying current to the street arc lights.

The 2300 volt and 4000 volt alternating current primary circuits deliver their current to transformers scattered throughout the entire area of the city, these transformers being for the purpose of lowering the potential of the current delivered to them to a suitable voltage for use by the consumers.

The secondary circuits, which lead from the transformers mentioned above, are of two types:

(1) Three-wire alternating current circuits carrying a potential of approximately 220 and 440 volts.

(2) Three-wire alternating current circuits carrying a potential of approximately 110 and 220 volts.

The 220-440 volt secondary distribution circuits are for the purpose of supplying to the consumers throughout the entire city, except the central business area, current for general use for light, heat and power.

[1]Extracts from Report on Gas and Electrical Conditions in City of Oakland, California.

The 110-220 volt secondary distribution circuits supply mainly the general consumers in the down-town area and also the electrolier street-lighting system on the principal down-town streets.

The service rendered by this system may be divided broadly, for the purposes of this report, into two classes: that rendered to private consumers, and that to the public for street lighting. In the first of these classes the city, in so far as it uses electric light and power for its public buildings, schools, etc., may be considered in the nature of a private consumer.

The current supplied to most of the private consumers throughout the city for the general purposes of light, heat and power is alternating current at a pressure of 220 and 440 volts. This applies to all except those in the down-town area served by underground circuits. The current supplied to the general consumers in this latter portion of the city is of the same nature but at 110 and 220 volts.

The current supplied to those consumers using direct current apparatus for power purposes is direct current at 500 volts.

The public service for street lighting is of two classes, so far as this report is concerned: Arc lighting for street illumination and incandescent lighting for street illumination.

The arc lamps employed by the city for street illumination are scattered throughout the entire area of the city, except the down-town business portion and a few principal streets that are illuminated by incandescent lamps. These are lamps of alternating current inclosed type, consuming a constant current of 7½ amperes. The total number of arc lights so employed is 920.

The incandescent street lighting employed by the city is wholly by means of electroliers, each employing ten 16-cp. 110 volt incandescent lamps. These are used in the down-town area and in a few principal streets leading therefrom. The total number of electroliers so employed is 792.

Service Rendered to Private Consumers.

Under this broad heading I will consider first: whether the system is fundamentally of such a nature as to give the class of service that should be given, and second, whether the system, as it is, is rendering as good service as could be expected of one of its type.

The City of Oakland stands almost alone in this country in the fact that alternating current for general lighting and power purposes is supplied to the residences and small business places at approximately 220 volts pressure. The almost universal practice, where alternating current is employed, is to supply it for the purposes now under consideration at 110 volts or thereabouts.

The broad question therefore arises at once as to whether 220 volts is as desirable as 110 volts for general light and power purposes. I have no hesitation in saying that it is not, and the fact that approximately 110 volts has been adopted almost universally as a standard for this class of service in this country is in itself prima-facie evidence of the truth of this statement.

The considerations, upon which 220-volt alternating current service supplied to the consumers over circuits carrying 220-440 volts, are to be condemned are two-fold: First, considerations of the hazard to life and property; second, considerations of economy and general usefulness to the consumer.

Considered from the standpoint of the hazard to life and property, the 110-volt service has distinct advantages over the 220-volt. It is true that 220-volt shocks are seldom fatal, though they have been known to kill, but with the three-wire system of distribution employed in Oakland it is possible for a person to receive a shock of 440 volts. This constitutes a grave danger to the general consumer under existing conditions in Oakland.

In the 110-220 volt three-wire alternating current lighting systems that are used almost exclusively in this country, in order to properly safeguard consumers from injury or loss of life by shock, it is now recommended by all authorities, including the American Institute of Electrical Engineers, the National Electrical Code and the National Electric Light Association, that the lighting systems be grounded at the neutral point; that is, permanently connected to ground so that not more than 110 volts can exist between any wire of such circuits and the earth. This is to prevent the existence of higher voltages, due to accidental leakage from other high voltage wires in the street, and also to prevent the consumer from being subject to the full 220 volt potential which exists in a 110-220 volt system.

In the 220-440 volt system employed in Oakland, the neutral points in some of the circuits are grounded, while in others they are not. The grounding of this point in the 220-440 volt circuits is not safe, because it greatly increases the danger of the consumers receiving 220-volt shocks. The system is not safe when the neutral is left ungrounded, because, while the liability of receiving 220-volt shocks is somewhat less, there is increased liability of 440-volt shocks, which, of course, are much more serious. The only way, therefore, to make the system thoroughly safe is to change to 110-volt service, thus making it possible, with safety, to ground the neutral point as a protection against higher voltages without introducing a dangerous condition due to the grounding itself.

It is an indisputable fact that 110-volt service is safer from the standpoint of fire hazard than 220-volt service, although of course it is possible to safeguard either of these systems to such an extent as to make either acceptable from this standpoint.

A comparison between the two voltages from the standpoint of hazard to life and property must always result distinctly to the advantage of lower voltage.

The most important advantage of 110-volt service over 220-volt service from the standpoint of economy and general usefulness to the consumer is that the modern types of incandescent lamps, which seem destined to revolutionize the incandescent lighting industry, are not well adapted for 220-volt service except in light-giving units that are too large for the ordinary consumers' use; and even with the old carbon filament lamp, which is made available for 220 as well as for 110-volt service, he is forced to use a lamp of distinctly inferior efficiency.

Considering first the carbon filament incandescent lamp, the difference in efficiency between a 110 and a 220 volt lamp of equal candle power and equal life is approximately 15 per cent in favor of lamps of the lower

voltage. The consumer in paying his electric light bills is paying primarily for light, and if conditions imposed by the service force him to use less effective means for turning his current into light, then, at equal rate of charge for current, he is forced to pay more for his light. This is true whether he buys his own lamps or whether they are furnished by the company.

A still more important disadvantage of the 220-volt service appears when the possible use of the more modern metallic filament lamps is considered. The tungsten lamp, which in my opinion will practically supersede the 16-cp. carbon filament lamp, has at least 2½ times the light-giving power for the same consumption of electric energy as the carbon filament lamp. Not only are these lamps more efficient, but they give better light, and under most circumstances have longer life. The importance to the consumer of this new form of incandescent lamp is obviously great, but the consumer who has only 220-volt service at his command cannot avail himself of it except in very small measure, because the tungsten lamp and other metallic filament lamps are not well adapted for 220-volt service.

Small transformers have been devised for use at the consumers' premises to lower the voltage to a suitable value for these lamps. This is always accompanied by a loss of energy for which the consumer pays and may be considered only as an expedient.

It is true that there are certain types of lamps which operate to somewhat better advantage on 220-volt than 110-volt service. These types of lamp, however, have not proven their adaptability to the illuminating purposes of the small user in general and have not, and probably will not, come into very wide use among small consumers.

Heating appliances, whether for cooking or other purposes, domestic or industrial, are distinctly more durable and somewhat cheaper in first cost when adapted for 110-volt service than for 220. It is probable that this factor is not an important one now, owing to the relatively small use of such heating appliances in Oakland, but it will increase in importance as the use of these devices becomes more general, due to the public becoming educated to their use and to reduction in the cost of current to the consumer.

I will conclude this portion of my report by saying that the 220-440-volt system of distribution, as installed in Oakland, is much more dangerous to life and property than 110-220-volt service would be, and that it possesses distinct disadvantages from the standpoint of economy and general utility. For these reasons you are warranted in making a very strong effort to induce the operating company in Oakland to make the change from the 220-volt to the 110-volt service. In making such change, that company will be taking a step, which, in my opinion, its own self-interest will eventually force it to take.

Good electric light and power service demands that the consumer shall always have on the wires at his premises a voltage which does not vary materially from the nominal voltage, that is, from the voltage which the company agrees to furnish and for which the consumers' lamps and other current-consuming devices are best adapted.

Constancy of the voltage is of great importance, particularly from the standpoint of incandescent light service, since momentary fluctuations in the voltage cause wide fluctuations in the illuminating power of the lamp, rendering a light which is not only unsatisfactory, but may be injurious to the eyes. It is almost equally important that the constant voltage should be the nominal voltage which is agreed upon between the company and the consumer. A voltage that is materially below the agreed or nominal value will result in the lamps being worked at very low efficiency, the return in light not being at a fair rate for the amount of energy paid for. On the other hand, keeping the voltage materially above the nominal value works havoc with the life of the lamps adapted to the nominal voltage. Where, as in Oakland, the service is on the meter basis, the consumers' electric light bills are also increased by too high voltage, because his lamps consume more current at the higher voltage; but this apparent disadvantage is offset by the fact that at the higher voltage his lamps work at increased efficiency and thus give more light for the money expended for electricity.

The current which the operating company agrees to supply in Oakland is sixty-cycle current at 214 volts. The nominal voltage is therefore 214.

For the purposes of this report numerous tests of the voltage were made at various consumers' premises, located at widely distributed points throughout the city, so as to obtain values that may be considered representative for the entire city. The points at which these observations were made were so selected as to make possible the taking of observations on all of the circuits employed in the city, except in the comparatively small underground system, and on each phase of each circuit. These observations in each case consisted in making readings every five minutes throughout the two-hour period from approximately 8 to 10 p. m.; this period having been chosen because it represented the time at which the electric light service is most used by the average consumer at this season of the year.

These tests show the following facts: The average voltage for the two-hour period at the respective points of test ranged from 241.5 volts, as a maximum average, down to 220 volts, as a minimum average. Thus in all cases the average voltage at each point was higher than the nominal voltage by amounts ranging from 27.5 volts down to 6 volts. Expressed in percentage, the average voltage thus ranged from 12.9 per cent too high down to 2.8 per cent too high.

Without considering the constancy of the pressure supplied at any one consumer's premises, as shown by the readings taken from time to time during a period of observations, it is at once apparent that the supply of current to the consumers is at a voltage greatly in excess of the nominal 214 volts.

In justice to the company, it may be said that many of the customers are using poor lamps, which at the proper voltage would give insufficient illumination, and it may be that the present high voltage is maintained for the purpose of satisfying the customers in this respect. Regardless of what the motives of the company may be, however, this is not the way to give good electric light service. What should be done is for the company to maintain as closely as possible the voltage that it agrees to supply, thus working the

lamps of the consumers at the candle-power and efficiency for which they were intended.

I am informed that the incandescent lamps purchased by the city for use in public schools and buildings are 214-volt lamps and are, therefore, of a type corresponding exactly with the voltage which the company agrees to supply. On the other hand, it was noted that many of the private consumers were provided with lamps marked for 220 volts. The voltage supplied, ranging as it did from 216 volts to 244 volts, would average much too high for either of these two types of lamps, and many lamps, particularly those used by the city, showed evidence of being worked under excessive pressure. If the company is to continue its policy of maintaining its pressure materially higher than the nominal pressure, I would recommend that the city, instead of purchasing 214-volt lamps which correspond exactly with the nominal voltage, purchase 220-volt lamps, thus approaching more nearly the actual voltage supplied.

Considering now the constancy of the voltage supply, the maximum voltage observed at any point was 244, which is 30 volts or 14 per cent higher than the nominal. The minimum voltage observed at any point was 216, which is 2 volts or 9 per cent higher than the nominal. The maximum and minimum did not occur at the same premises.

The greatest variation noted at any one test point was from 235 volts to 218 volts, a variation of 17 volts or 7.8 per cent of the minimum. The smallest variation noted at any test point was from 240 volts, as a maximum, to 235 volts, as a minimum, a variation of 5 volts or 2.1 of the minimum.

A variation of only 5 volts would not be objectionable at any one station, provided the range was between the proper limits, but a variation of 17 volts would be too high under any circumstances. An analysis of the voltage readings taken during a two-hour period at some of the stations showing poor regulation, indicates in almost all cases that the voltage maintained was fairly constant for a period of about an hour, and then suddenly changed to another voltage, in all cases higher. This change occurred at about the hour of 9 o'clock and would seem to indicate a radical change at that time either in the loading of the circuits or in the source of supply. The moment-to-moment variation was not, therefore, quite as bad as would be indicated from the results given in the attached table, but this does not alter the fact that the variation is there and that in all cases the voltages are altogether too high in comparison with the nominal voltage.

Concerning a proper requirement for the allowable variation of voltage at the consumer's premises, I will say that some companies aim at and practically attain a maximum variation of 2½ volts above and below the nominal pressure.

A 4700 foot dam with 4400 feet of spillway is being built across the Mississippi river at Keokuk, Iowa. The dam will be built of re-inforced concrete, with a height of 37 feet and a base of 43 feet. The water thus diverted will drive 30 turbine-units consisting of double waterwheels and generator. The ultimate development will be 200,000 h.p. for distribution throughout the Middle West the first transmission line being to St. Louis, a distance of 170 miles.

THE HOLTVILLE POWER COMPANY.

The Holtville Power Company operates a hydro-eletric plant at Holtville in the Imperial Valley of California, which is said to be the only power plant below the level of the sea. Water is diverted from the main canal of the California Company three miles from Holtville. From the power company's ditch the water passes into a 50-in. wood stave pipe, 200 ft. long, which acts as a pen stock and gives a head of 76 ft. at the power house in the canyon of the Alamo river.

Recently a new concrete powerhouse has been completed, augmenting the 250 kw. Allis-Chalmers

Hydro-electric Plant of Holtville Power Company.

turbine and Bullock generator in the older brick powerhouse with a 350 and a 700 kw. unit of the same make. The transmission lines extend for eleven miles from Holtville to El Centro, radiating thence 10 miles to Calexico, 4 miles to Imperial and 11 miles to Brawley.

The auxiliary steam plant at El Centro is equipped with a 250 kw. generator driven by a St. Louis Corliss engine, supplied from Sterling boilers. This steam plant, also furnishes power for the ice and cold storage plant at El Centro with a production of forty-five tons of ice daily, and a storage capacity of 6000 tons. An additional 35-ton machine is now being installed.

An electric time recorder is used to determine the time and speed of flight in German air-ship competition. It consists of a recording clock connected by electric wires to the different observers who can record the time of the air ships passing by pushing a button thus actuating an electric magnetic marker in the clock. This together with a telephone system insures accuracy and prevents disputes.

HOW TO FIGURE COST OF ELECTRIC POWER.

BY S. V. WALTON.[1]

The purpose of the accompanying tables is to enable any one to determine by them the cost of any amount of electric power. Suppose, for example, A has a plant to be equipped, say, with a 75 h.p. motor. He wishes to operate, say, 12 hours a day. He learns that he can secure electric current,

He refers to the first table, and glances down the first column till he comes to 3 cents the kilowatt hour. Opposite that, in the next column, he sees 2.238 cents, which is the equivalent rate for one horsepower, since one horsepower equals 746 watts or .746 of one kilowatt. Then finding the column headed 12 and following it down to the line opposite the 3 cents of the first column he finds $10.95, which is the monthly cost, and opposite this, in the next column, is $131.40, which is the annual cost. Continuing on into the next column he finds $8.17, which is the monthly cost of one horsepower, and in the next column, just opposite, is $98.02, the yearly cost of one horsepower.

Multiplying these monthly and yearly horsepower costs by 75 he has the cost for his plant. Suppose now that he have his motor tested and find that it is taking only 60 horsepower. Then his power costs should be reduced accordingly, by figuring them at 60 horsepower instead of 75.

These tables save much figuring.

[1]Manager Commercial Department, Pacific Gas and Electric Company.

COST OF POWER (1 FULL MONTH = 730 HRS.)

HRS. PER DAY	10		12		14		16		18		22		24	
	MONTH 304	YEAR 3650	MONTH 365	YEAR 4380	MONTH 426	YEAR 5110	MONTH 487	YEAR 5840	MONTH 548	YEAR 6570	MONTH 669	YEAR 8030	MONTH 730	YEAR 8760
RATE PER KW HR CENTS	COST		COST		COST		COST		COST		COST		COST	
3	$0.91	$10.95	$1.10	$13.14	$1.28	$15.33	$1.46	$17.52	$1.64	$19.71	$2.01	$24.09	$2.19	$26.28
3.5	1.06	12.78	1.28	15.33	1.49	17.89	1.71	20.44	1.92	23.00	2.34	28.11	2.55	30.66
4	1.22	14.64	1.46	17.52	1.70	20.44	1.95	23.36	2.19	26.28	2.68	32.12	2.92	35.04
4.5	1.37	16.45	1.64	19.71	1.92	23.00	2.19	26.28	2.47	29.57	3.01	36.14	3.28	39.42
5	1.52	18.25	1.83	21.90	2.13	25.56	2.44	29.20	2.74	32.85	3.34	40.16	3.65	43.80
5.5	1.67	20.06	2.01	24.08	2.34	28.11	2.68	32.12	3.01	36.14	3.68	44.17	4.01	48.18
6	1.82	21.86	2.19	26.28	2.55	30.66	2.92	35.04	3.29	39.42	4.02	48.19	4.38	52.56
6.5	1.98	23.71	2.37	28.41	2.77	33.23	3.17	37.98	3.56	42.71	4.35	52.21	4.74	56.94
7	2.13	25.56	2.55	30.66	2.98	35.77	3.41	40.88	3.84	46.06	4.69	56.23	5.11	61.32
7.5	2.28	27.36	2.74	32.85	3.20	38.33	3.65	43.80	4.11	49.28	5.02	60.25	5.47	65.70
8	2.43	29.21	2.92	35.04	3.41	40.88	3.90	46.72	4.38	52.56	5.35	64.24	5.83	70.08
8.5	2.58	31.02	3.10	37.23	3.62	43.44	4.14	49.66	4.66	55.86	5.69	68.26	6.21	74.46
9	2.73	32.82	3.29	39.42	3.83	45.99	4.38	52.56	4.93	59.13	6.02	72.27	6.56	78.84
9.5	2.89	34.68	3.47	41.61	4.05	48.65	4.63	55.46	5.21	62.46	6.36	76.28	6.94	83.28
10	3.04	36.48	3.65	43.80	4.26	51.10	4.87	58.40	5.48	65.70	6.69	80.30	7.30	87.60
11	3.34	40.13	4.01	48.18	4.68	56.20	5.35	64.24	6.02	72.27	7.35	88.32	8.03	96.36
12	3.64	43.80	4.38	52.56	5.11	61.32	5.84	70.08	6.57	78.84	8.03	96.36	8.76	105.12
13	3.95	47.45	4.74	56.94	5.53	66.42	6.33	75.98	7.12	85.41	8.70	104.40	9.50	114.00
14	4.25	51.10	5.11	61.32	5.96	71.54	6.82	81.76	7.67	92.04	9.37	112.44	10.22	122.64
15	4.56	54.75	5.47	65.70	6.39	76.66	7.31	87.60	8.22	98.63	10.03	120.48	10.95	131.40
16	4.86	58.40	5.84	70.08	6.82	81.77	7.80	93.44	8.77	105.18	10.70	128.46	11.68	140.16
17	5.17	62.05	6.20	74.46	7.24	86.93	8.28	99.36	9.31	111.69	11.37	136.56	12.41	148.92
18	5.47	65.70	6.57	78.84	7.67	91.98	8.77	105.18	9.86	118.26	12.04	144.54	13.14	157.68
19	5.78	69.35	6.93	83.22	8.09	97.07	9.25	111.00	10.40	124.83	12.71	152.57	13.87	166.44
20	6.08	73.00	7.30	87.60	8.52	102.20	9.74	116.88	10.95	131.40	13.38	160.62	14.60	175.20
21	6.38	76.65	7.66	91.98	8.94	107.30	10.22	122.64	11.49	137.97	14.04	168.48	15.33	183.96
22	6.69	80.30	8.03	96.36	9.37	112.44	10.71	128.46	12.04	144.54	14.72	176.66	16.06	192.72
23	6.99	83.95	8.39	100.74	9.80	117.63	11.20	134.40	12.59	151.11	15.39	184.74	16.79	201.48
24	7.29	87.60	8.76	105.12	10.22	122.64	11.68	140.16	13.14	157.68	16.06	192.72	17.52	210.24
25	7.60	91.25	9.13	109.50	10.65	127.76	12.16	145.92	13.68	164.25	16.72	200.70	18.25	219.00
26	7.90	94.90	9.49	113.88	11.08	132.89	12.66	151.92	14.23	170.82	17.39	208.68	18.98	227.76
27	8.21	98.55	9.86	118.26	11.50	137.97	13.14	157.68	14.78	177.39	18.06	216.72	19.71	236.52
28	8.51	102.20	10.22	122.64	11.93	143.16	13.63	163.56	15.33	183.96	18.73	224.76	20.44	245.28
29	8.82	105.85	10.59	127.02	12.36	148.18	14.12	169.44	15.88	190.53	19.40	232.80	21.17	254.04
30	9.12	109.50	10.95	131.40	12.78	153.36	14.60	175.20	16.43	197.10	20.07	240.84	21.90	262.80

COST OF POWER. (1 FULL MONTH = 730 HRS.)

HRS. PER DAY	10		12		14		16		18		22		24	
	MONTH 304	YEAR 3650	MONTH 365	YEAR 4380	MONTH 426	YEAR 5110	MONTH 487	YEAR 5840	MONTH 548	YEAR 6570	MONTH 669	YEAR 8030	MONTH 730	YEAR 8760
RATE PER KW HR CENTS	COST		COST		COST		COST		COST		COST		COST	
31	9.43	113.15	11.32	135.78	13.21	158.41	15.10	181.04	16.98	203.67	20.74	248.93	22.63	271.56
32	9.73	116.80	11.68	140.16	13.63	163.54	15.57	186.82	17.52	210.24	21.41	256.96	23.36	280.32
33	10.03	120.45	12.04	144.54	14.05	168.67	16.06	192.72	18.06	216.81	22.07	264.99	24.09	289.08
34	10.34	124.10	12.41	148.92	14.48	173.80	16.55	198.58	18.62	223.38	22.75	273.00	24.82	297.84
35	10.64	127.75	12.77	153.30	14.90	178.93	17.03	204.36	19.16	229.95	23.41	281.04	25.55	306.60
36	10.94	131.40	13.13	157.68	15.32	183.96	17.52	210.24	19.71	236.52	24.08	289.08	26.28	315.36
37	11.25	135.05	13.50	162.00	15.75	189.07	18.00	216.00	20.25	243.05	24.75	297.11	27.01	324.12
38	11.55	138.70	13.86	166.32	16.17	194.16	18.48	221.76	20.79	249.58	25.41	305.14	27.74	332.88
39	11.86	142.35	14.23	170.76	16.60	199.25	18.97	227.64	21.33	256.15	26.08	313.17	28.47	341.64
40	12.16	146.00	14.59	175.08	17.02	204.34	19.46	233.52	21.89	262.74	26.75	321.21	29.20	350.40
41	12.46	149.65	14.95	179.46	17.44	209.43	19.94	239.28	22.43	269.31	27.42	329.25	29.93	359.16
42	12.77	153.30	15.32	183.84	17.87	214.52	20.43	245.16	22.97	275.82	28.09	337.26	30.66	367.92
43	13.07	156.95	15.68	188.22	18.29	219.61	20.92	251.04	23.52	282.39	28.76	345.30	31.39	376.68
44	13.37	160.60	16.04	192.60	18.71	224.70	21.40	256.80	24.06	288.96	29.43	353.34	32.12	385.44
45	13.68	164.25	16.41	196.98	19.14	229.79	21.89	262.68	24.61	295.53	30.10	361.35	32.85	394.20
46	13.98	167.90	16.78	201.36	19.57	234.88	22.38	268.56	25.16	302.10	30.77	369.39	33.58	402.96
47	14.29	171.55	17.15	205.74	20.00	240.00	22.87	274.44	25.71	308.67	31.44	377.44	34.31	411.72
48	14.59	175.20	17.51	210.12	20.42	245.09	23.36	280.32	26.26	315.24	32.11	385.44	35.04	420.48
49	14.90	178.85	17.88	214.56	20.85	250.18	23.86	286.32	26.82	321.84	32.78	393.48	35.77	429.24
50	15.20	182.50	18.24	218.88	21.28	255.27	24.35	292.20	27.38	328.41	33.46	401.52	36.50	438.00
51	15.50	186.15	18.61	223.32	21.71	260.36	24.84	298.08	27.93	334.98	34.13	409.56	37.23	446.76
52	15.81	189.80	18.97	227.70	22.13	265.45	25.33	303.96	28.48	341.55	34.80	417.60	37.96	455.52
53	16.11	193.45	19.34	232.08	22.56	270.54	25.82	309.84	29.03	348.12	35.47	425.64	38.69	464.28
54	16.42	197.10	19.70	236.46	22.99	275.63	26.31	315.72	29.59	354.69	36.14	433.68	39.42	473.04
55	16.72	200.75	20.07	240.84	23.41	280.72	26.80	321.60	30.14	361.26	36.81	441.72	40.15	481.80
56	17.03	204.40	20.43	245.16	23.84	285.81	27.29	327.48	30.69	367.83	37.48	449.76	40.88	490.56
57	17.33	208.05	20.80	249.60	24.26	290.90	27.78	333.36	31.24	374.40	38.15	457.80	41.61	499.32
58	17.64	211.70	21.16	253.92	24.69	295.99	28.27	339.24	31.80	380.97	38.82	465.84	42.34	508.08
59	17.94	215.35	21.53	258.36	25.11	301.08	28.76	345.12	32.35	387.54	39.49	473.88	43.07	516.84
60	18.25	219.00	21.90	262.80	25.56	306.60	29.26	351.12	32.90	394.80	40.16	481.92	43.80	525.60
61	18.55	222.65	22.26	267.12	25.97	311.71	29.73	356.76	33.44	401.28	40.83	489.96	44.53	534.36
62	18.85	226.30	22.63	271.56	26.41	316.81	30.22	362.64	33.99	407.85	41.50	498.00	45.26	543.12
63	19.15	229.95	22.99	275.88	26.83	321.90	30.71	368.52	34.54	414.42	42.17	506.04	45.99	551.88
64	19.46	233.60	23.36	280.32	27.26	327.02	31.20	374.40	35.09	420.99	42.84	514.08	46.72	560.64
65	19.76	237.25	23.72	284.64	27.68	332.11	31.68	380.16	35.64	427.56	43.51	522.12	47.45	569.40

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

The following papers have been announced for presentation at the coming convention of the Association of Railway Telegraph Superintendents, to be held at Los Angeles, Cal., June 20, 21, 22, 23 and 24.

"Wireless Telegraphy," by William Maver, Jr.

"Education for Efficient Railroad Service," by D. C. Buell.

"Protecting Telephone Lines from Lightning and Other Disturbances," by M. E. Launbranch.

"Automatic Block and Highway Crossing Signaling," by H. P. Ryner.

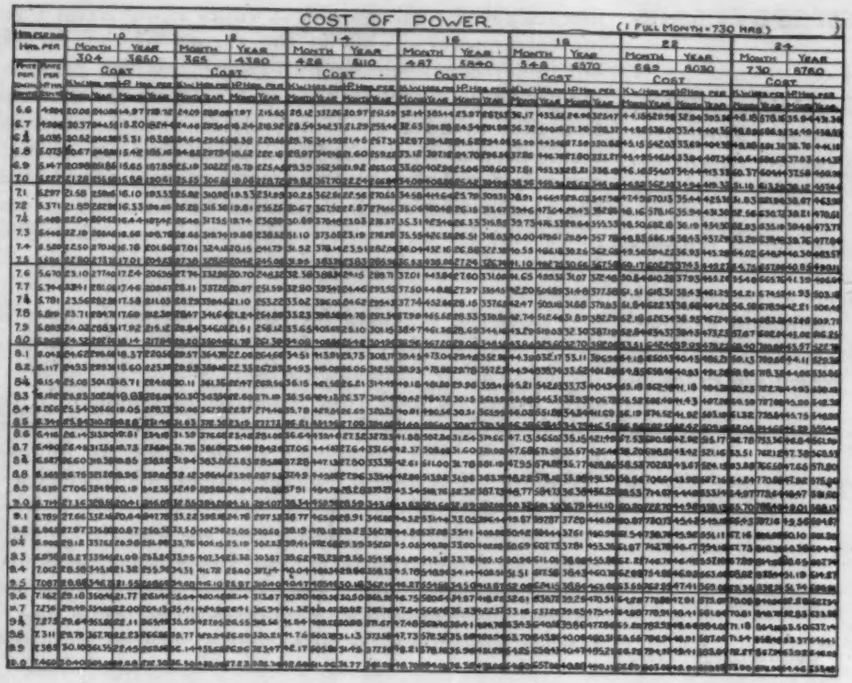
"Telephone Train Dispatching," by E. E. Dildine.

"Testing of Telegraph and Telephone Circuits," by V. E. Kissinger.

"Telephoning to and from Trains," by E. P. Griffith.

"Composite Telephone Blocking," by W. F. Williams.

Several matters of importance will be discussed at the executive sessions, and a fine program of entertainments is being provided.


COST OF POWER.

(1 FULL MONTH = 730 HRS.)

Price per Kw. hr.	10		12		14		16		18		22		24	
	Month 304	Year 3650	Month 365	Year 4380	Month 428	Year 5110	Month 487	Year 5840	Month 548	Year 6570	Month 662	Year 8030	Month 730	Year 8760
	Cost		Cost		Cost		Cost		Cost		Cost		Cost	
6.6	4.00	20.06	24.08	4.97	28.12	33.76	20.97	29.59	32.14	38.54	45.97	55.16	36.17	43.36
6.7	4.06	20.37	24.45	5.20	28.54	34.25	21.29	25.46	32.63	39.15	46.54	55.85	36.72	44.06
6.8	4.13	20.68	24.82	5.31	28.96	34.75	21.60	25.92	33.12	39.74	47.25	56.70	37.28	44.74
6.9	4.19	20.98	25.18	5.42	29.38	35.25	21.92	26.30	33.60	40.32	47.96	57.54	37.81	45.38
7.0	4.25	21.28	25.54	5.54	29.82	35.78	22.24	26.69	34.09	40.91	48.65	58.38	38.36	46.04
7.1	4.32	21.58	25.90	5.62	30.25	36.29	22.56	27.05	34.58	41.49	49.35	59.21	38.91	46.69
7.2	4.38	21.89	26.26	5.70	30.67	36.80	22.88	27.45	35.06	42.08	50.05	60.05	39.45	47.34
7.3	4.44	22.19	26.62	5.78	31.10	37.30	23.19	27.83	35.55	42.66	50.74	60.89	40.00	47.99
7.4	4.50	22.50	27.00	5.86	31.52	37.82	23.51	28.21	36.04	43.25	51.44	61.73	40.55	48.65
7.5	4.56	22.80	27.36	5.94	31.95	38.34	23.83	28.59	36.53	43.84	52.14	62.57	41.10	49.32
7.6	4.63	23.10	27.74	6.02	32.38	38.86	24.15	28.98	37.02	44.42	52.83	63.41	41.65	49.98
7.7	4.69	23.41	28.09	6.10	32.80	39.36	24.46	29.35	37.50	45.00	53.53	64.25	42.20	50.64
7.8	4.75	23.71	28.45	6.18	33.23	39.88	24.78	29.74	37.99	45.59	54.23	65.09	42.75	51.30
7.9	4.81	24.02	28.83	6.26	33.66	40.39	25.10	30.12	38.48	46.18	54.93	65.93	43.30	51.96
8.0	4.88	24.32	29.18	6.34	34.08	40.90	25.42	30.50	38.96	46.76	55.62	66.77	43.85	52.62
8.1	4.94	24.62	29.54	6.42	34.51	41.41	25.73	30.88	39.45	47.34	56.32	67.61	44.39	53.27
8.2	5.00	24.93	29.92	6.50	34.94	41.92	26.05	31.26	39.93	47.92	57.02	68.45	44.94	53.93
8.4	5.13	25.54	30.66	6.66	35.80	42.96	26.69	32.03	40.91	49.10	58.41	70.13	46.04	55.25
8.6	5.25	26.15	31.39	6.82	36.65	43.98	27.33	32.79	41.89	50.27	59.81	71.81	47.14	56.57
8.8	5.38	26.76	32.12	6.98	37.50	45.00	27.97	33.56	42.87	51.45	61.21	73.49	48.24	57.89
9.0	5.50	27.36	32.85	7.14	38.35	46.02	28.60	34.32	43.85	52.62	62.60	75.17	49.34	59.21
9.2	5.63	27.97	33.58	7.30	39.20	47.04	29.24	35.09	44.83	53.80	64.00	76.85	50.44	60.53
9.4	5.75	28.58	34.31	7.46	40.05	48.06	29.88	35.85	45.81	54.97	65.40	78.53	51.54	61.85
9.6	5.88	29.18	35.04	7.62	40.91	49.08	30.52	36.62	46.79	56.15	66.79	80.21	52.64	63.17
9.8	6.00	29.79	35.76	7.78	41.76	50.10	31.15	37.38	47.77	57.32	68.19	81.89	53.74	64.49
10.0	6.13	30.39	36.49	7.94	42.61	51.12	31.79	38.15	48.75	58.50	69.59	83.57	54.84	65.81

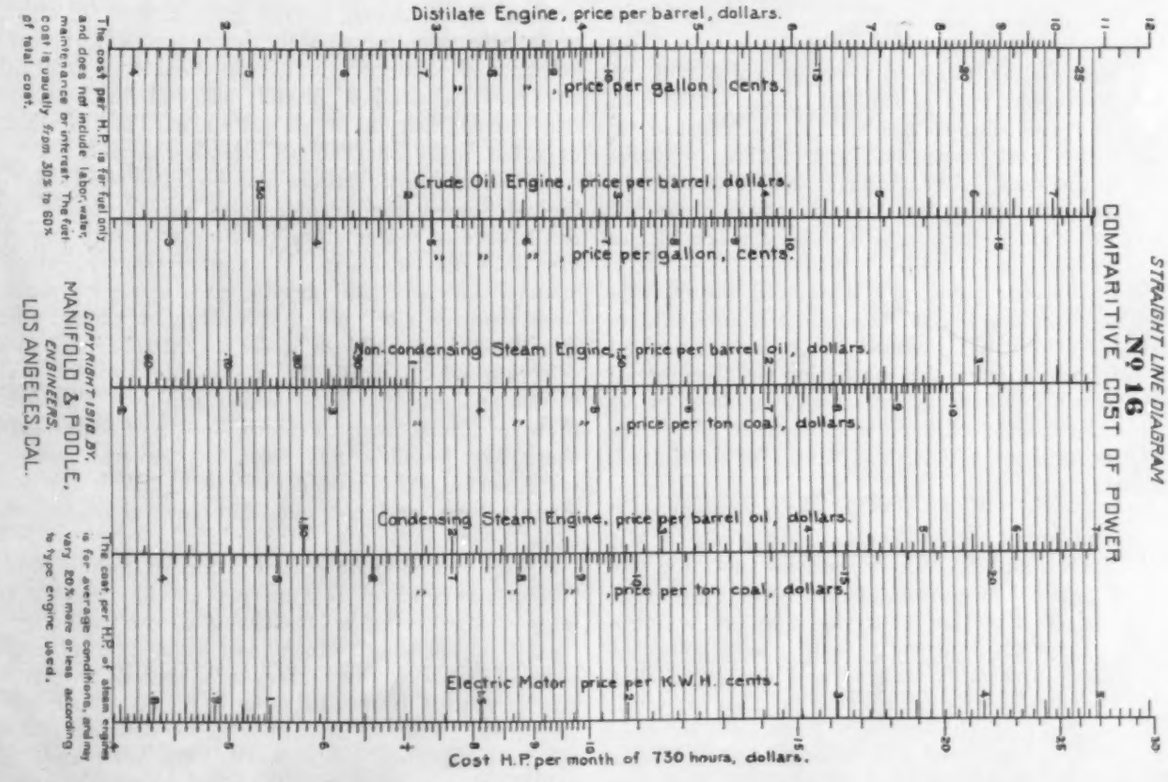
COMPARATIVE COST OF POWER.

In connection with the accompanying tables showing the cost of electric power we publish, by permission, from Manifold & Poole's "Straight Line Engineering Diagrams," one of a new set of ten which has recently been added to this collection. This diagram gives a graphic representation of the comparative cost of power from different prime movers and may be used as a basis for determining the most economical power source.

As will be noted from the diagram comparison is made between a distillate engine, a crude oil engine, a non-condensing steam engine, a condensing steam engine and an electric motor at various prices for fuel or electricity. These costs do not include labor, water, maintenance, depreciation or interest, being for fuel only. The figures are based on average conditions for Pacific Coast practice.

Corresponding costs may be found along the same horizontal line. For instance we find that the power developed by a distillate engine with gasoline at 5 cents per gallon is equivalent to that developed by a crude oil engine with oil at $1.47 per barrel or 3½c per gallon, to that of a non-condensing steam engine with coal at $2.58 per ton or to an electric motor with power at .93 cent per kw. hr.

The diagram also shows the relative fuel values of coal and of oil and the relation between barrels and gallons of oil. Other uses will suggest themselves to the reader who will find it a convenient means of conversion and comparison. While its values are necessarily approximate they give a rough and ready method for field use which can be checked when more complete data is available in the office.


Distillate Engine, price per barrel, dollars.
, price per gallon, cents.
Crude Oil Engine, price per barrel, dollars.
, price per gallon, cents.
Non-condensing Steam Engine, price per barrel oil, dollars.
, price per ton coal, dollars.
Condensing Steam Engine, price per barrel oil, dollars.
, price per ton coal, dollars.
Electric Motor price per K.W.H. cents.
Cost H.P. per month of 730 hours, dollars.
STRAIGHT LINE DIAGRAM
No 16
COMPARITIVE COST OF POWER
The cost per H.P. is for fuel only and does not include labor, water, maintenance or interest. The fuel cost is usually from 30% to 60% of total cost.
The cost per H.P. of steam engines is for average conditions, and may vary 20% more or less according to type engine used.
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SELECTING WATER-POWER SITES BY CLAIRVOYANCE.

BY RUSSELL L. DUNN.

"Water-power sites" are not natural things. When they exist at all they are artificial things. They happen as results of a selection, corresponding to a fabrication, made with intention to accomplish particular desired commercial results.

Comprehensively, a "water-power site" is the surface of the land on which are emplaced all of the fabricated water works which turn or divert water from the situs of its natural fall, described commonly as flow, and on the selected artificial situs convert that fall into that physical form of energy which we describe as work.

In detail, the fabricated waterworks may include as items, all, or only a part of:

1. Dams (one or several) placed in the bed of the natural channels of water flow.
2. Canal, ditch, flume, or pipe, (one or several), conduits for the water.
3. Reservoir (one or several) conduits for the water.
4. Penstock (one or several) conduits for the water and at the same time part of the engine for converting the fall of the water into work.
5. Power house (one or several) sheltering the more obvious parts of the engine for converting the fall of the water into work, and water-wheels, air compressors and electric generators.
6. Power transmission conduit (one or several); poles, pulleys and cables or ropes for transmission of direct water-power (work), poles and wires for transmission of work as electric power, and pipes for transmission of work as compressed air power.

The indispensable items are "penstock" and "power transmission conduit." The "penstock" may be emplaced in the natural situs of the water flow and be itself arranged as an air compressor which will automatically convert part of the fall of the water into "work." A "pipe line" to conduct the compressed air will make the work commercially available as "compressed air power." Any engineer will immediately think of particular plans for the conversion of the fall of water into work from which one or more of the above mentioned items will be missing.

Practically, the particular fabricated waterworks of the above items are first determined from commercial considerations, are planned to produce a desired commercial result from the marketing or commercial use of "work" (which is commonly spoken of as power) and the situs of their emplacement, the selection of the land on which they would be fabricated, comes last.

The theory of "conservation of water-power sites," which was invented for ex-President Roosevelt by Mr. Gifford Pinchot and by their strenuous advocacy has become a political issue, has obviously assumed that the order of construction of a water-power business is just the opposite—that the situs of emplacement of waterworks is invariably natural and exclusive, that the situs is definable or ascertainable from an examination of the land surface, and that the situs is selected in advance of planning the waterworks and in advance of desiring any particular commercial result from the marketing of work as one or other commercial form of water-power. This is the theory of the Pickett bill under consideration by Congress, which provides for public land withdrawals in blocks on the assumption that in advance of any determined commercial result desired by anybody Federal bureau officials can select and classify the parcels of public land from the blocks which will thereafter be the situs of emplacement for any waterworks which may thereafter be planned to produce particular commercial results for someone.

Now the practical fact of the matter being that the situs of emplacement is selected after the particular fabrication of waterworks is planned, the latter only being planned after a particular commercial result from the marketing of a particular form of water-power has been conceived as desirable, it follows, therefore: that unless Federal bureau officials charged with the duty of classifying "water-power sites" from the public land have the clairvoyant knowledge with which to forsee the future, to forsee what particular commercial result from water-power manufacture will be conceived sometime by someone as desirable, and to foresee the particular waterworks fabrication which will then be planned—unless they have this power of second sight to read the future before it comes—they will certainly be unable to select now the situs of emplacement of waterworks which have not even been conceived—that is pick out particular parcels of public land which will be, **not are**, "water-power sites."

It is of course conceivable that Federal bureau officials will be able to select land which can be used for the emplacement of waterworks of their planning to produce a commercial result which they may conceive as desirable, but, for the moment going a step further—assume the government selection made and a price or conditions named by the government for the use of the selection, immediately thereupon the government selection becomes competitively considered with other sites and that site is ultimately adopted which produces the best commercial result quite regardless of whether or not it is the government selection or not.

Illustrating this, there may be taken the U. S. Geological Survey topographic atlas sheets of any western source of water supply with the public land survey lines platted on it. No matter what selection of 40-acre parcels of land may be made as a governmental "water-power site" for that source of water supply, it will still be possible to make an entirely independent selection which would be a possible site for waterworks utilizing the same water supply. The fact is that for almost every western source of water supply there are possible not one, but several, plans of waterworks which would make it available for power manufacture, and not one, but several water-power sites.

Any selection or classification of public land as "water-power sites" is a mere pretense unless it contemplates selecting or classifying all the public land as "water-power sites" which may by any possible planning of disposition of waterworks become the situs of any of them. If this be done it means the indefinite withdrawal from settlement or other disposal of about all the remaining public land fit for settlement situated in the western states. After a water-power site

is commercially selected from it, the other land reserved pending this commercial selection may or may not become available for settlement and other disposal. It is quite conceivable that even after a commercial selection has been made it may be abandoned and another selection made which might take advantage of the premature disposal of the other land.

It is indisputable that if there be selected all of the 40-acre parcels of public land which touch the natural channels of water flow, then the Federel government will have land some of which must be used as part of the situs of waterworks for power manufacture. The public land so reserved by selection would hardly be describable as water-power sites, however. It would operate to fence in water owned by the states very much as the commercial device termed a "spite fence" encloses the plot of a land owner so that he cannot get full use and full value out of his property.

If the Federal government were to go about getting what some of its administrative officials seem to want in this direct mode, there would be no reason for the withdrawal of public land in blocks as proposed by the Pickett bill. It would only be necessary to amend the existing public land laws by providing that there should be reserved from disposal any 40-acre tract traversed by or bordering on any natural water flow. Then the United States spider could sit in the midst of the web absolutely sure that the private flies would be caught when they come to get water. But, this would only happen when all the land bordering on water flows is public land, a condition quite unusual in any of the states, although usual in some of the territorial possessions. In the states where much land bordering on water flows having convertible falls is already private land, the withdrawal must include practically all the public land which is worth anything for settlement as well as what public land there is on the water courses.

Much has been made in yellow print of what has already been accomplished by Federal bureau officials in so-called saving to the people of "water-power sites." If the particular instances be examined in detail it will appear that in no case has anything been accomplished by the selective initiative of Federal bureau officials in defining "water-power sites." Every case has been a case of initiative by private persons who have planned particular fabrications of waterworks for particular commercial results of their own conception. It has happened that some of the situs of emplacement proposed is public land. The Federal bureau officials being advised of this selection have thereupon selected the same parcels of public land as "water-power sites," and by preventing the use of these parcels for the situs of the planned structures except on their own arbitrary conditions claim that they have saved them for the people.

Owens river as a source of water supply for power manufacture has already furnished three instances which illustrate what has just been stated. In two the entire fabrication of waterworks proper is on private land, only a part of the situs of emplacement of the pole and wire line conduit for electric power happens to be public land. Further, the public land is desert in character, unavailable for settlement except as mining causes temporary settlement. There being no color of law at the time for Federal bureau interference with the appropriation of a pole and wire line easement on desert public land, the Federal bureau officials selected from this public land parcels covering a barren mountain range on which there was a scattered nut pine growth of absolutely no economic value except as a temporary source of fuel for mining, and officially declared it a national forest. A few miles of pole and wire electric power conduit being unavoidably within this "faked" national forest the Federal Forestry bureau declared (in effect) the situs of this line within the faked national forest a "water-power site" and proceeded to prevent its use except on impossible conditions which were not acceded to. The saving to the people accomplished by the Forestry bureau officials has been the shutting out of one of the two enterprises from its intended market, the mines of Goldfield, and the needless creation of a monopoly of power business in Goldfield and Tonopah for the other enterprise.

The third instance is the power manufacturing enterprise of the City of Los Angeles in which the entire fabrication of waterworks is on private land except parts of the canal and pipe line conduit of the water which in this case will be used in a power house 180 miles distant from the natural source of the water. The "water-power site" on the public land in this instance consists of a part of the situs of the water conduit. The location of the situs has been changed as the actual fabrication of the water conduit has progressed. The entire location is the result of private initiative.

Now the point of mentioning these instances is this. Ten years back in time neither Goldfield nor Tonopah existed, nor had the idea been conceived of Los Angeles manufacturing water-power from the use of Owens river by the absolute creation of an artificial fall for its water 180 miles away from the river. How then could Federal bureau officials have selected ten years ago the public land parcels from block withdrawals which are now, to employ their own descriptive term, "water-power sites" of Owens river, California? Could they have done it ten years ago had then Chief Forester Pinchot given his young assistants the advantage of a college education at public expense in the black art of "clairvoyance" as well as a college education in forest culture and rain-making? If Federal bureau officials could not have looked into the crystal ten years ago and there and then seen the "water-power sites" which are to-day, how then shall they today look into the crystal and see in the withdrawn blocks of public land the "water-power sites" of the next century's making? "Pish!" with apology to Omar Khayam, "Ex-Chief-Forester Pinchot is a good fellow. He means well."

Regulation of Niagara's power development is provided in a treaty recently signed by the United States and Great Britain. The Canadian side is to be permitted the use of 36,000 cubic feet per second, while the New York side will be allowed to use 20,000 cubic feet per second. The Canadian allotment will make possible a much larger development than is now in use, but as the developing companies are permitted by the Canadian authorities, as well as by the United States authorities, to transmit and sell in the United States at least half of the power generated in Canada, the New York side is benefited by the Canadian development.

POWER DEVELOPMENT IN THE PUGET SOUND COUNTRY.[1]

Industrial development always follows the line of least resistance. The localities that attain pre-eminence in industry are those which are rich in transportation facilities, in varied natural resources, and in the means of generating power. A locality may become great through the possession of two, or even one, of these characteristics; but ideal conditions are found only when the three are combined. The Puget Sound country is industrially in its infancy: though it has already acquired large stature, its growth is insignificant in comparison with that for which all its conditions are preparing it. It has hydroelectric potentialities many times in excess of its present industrial activity; it has raw materials suitable for manufacturing on the greatest scale; and nowhere in either hemisphere are there better facilities for transportation.

There is no mistaking the conclusion to be drawn from the fact that the population of Seattle has increased from 80,000 in 1900 to approximately 300,000 in 1910, or that Tacoma has in the same period grown from less than 38,000 to 125,000. Such figures can mean but one thing; they indicate the birth throes of cities of the first magnitude. These great and rapidly growing Puget Sound cities have a significance that is possessed by almost every American city of size; that is, they signify a surrounding country rich either in natural resources or in industrial activity. These particular cities represent both great natural resources and rapid strides in their industrial development.

It was no longer ago than 1853 that the State of Washington was part of the Territory of Oregon. In those days there were no more than a handful of people there. Today there are practically a million and a half; and by far the greater part of this growth has fallen within the last two decades. When one notes such an extensive movement of population as this, it is perfectly safe to infer industrial opportunities of the first order. These opportunities have been sufficiently developed in the last decade or two for their real character to be seen. The magnificent forests of Washington have been productive of a vast lumber industry, and have made the rapidly growing city of Everett the most important point on earth for the export of shingles. The climate is such that agriculture is here pursued under the most advantageous conditions. In the Puget Sound country are vast deposits of coal, and although these are hardly at the beginning of their development, Washington is annually mining 3,000,000 tons of coal. Much of the bituminous coal here found is of excellent coking character, a fact of importance in view of the iron deposits of which this region is possessed. Though the metals have not been among the leading causes of the present prosperity of Washington, the industry has not been neglected; the mines of the State are producing gold, silver, lead, copper, quicksilver, zinc, arsenic, antimony, molybdenum, nickel, cobalt, tungsten, titanium, bismuth, sulphur, selenium, tellurium, tin and platinum. Mention should also be made of the fisheries; its salmon canneries have carried the name of the bustling manufacturing city of Bellingham far and wide.

[1]Public Service Journal.

Here we have the raw materials of a great industrial community. To these must be added the vast transportation facilities with which the State has been and still is being equipped in order to make effective the opportunities for commerce afforded by the peculiar coast line of Puget Sound. And for the most successful exploitation of all these resources and facilities, the State of Washington is endowed with hydroelectric potentialities of a character to stamp this region as "the most fertile field for power development in the United States."

The purpose of this article is to dwell on certain features of the power situation in that part of the Pacific Northwest commonly known as the Puget Sound Country. This district comprises the territory lying between the Olympic and Cascade mountains, its chief physical feature being the great island sea known as the Puget Sound. The shore of this body of water exceeds 2000 miles and is broken by numerous bays and harbors, upon which are located Seattle, Tacoma, Everett and Bellingham. This country possesses a most equable climate, mild in winter and cool in summer. Its natural resources are multifold, and to their development may be traced the rise of that long chain of prosperous cities and thriving towns which have made "Puget Sound" a familiar phrase in two hemispheres—Bellingham with its 40,000 population, Everett with 36,000, Seattle with 300,000 and Tacoma with 125,000. Here we find lumbering conducted on a most extensive scale; and here, on the deforested lands, agriculture has for years been appealing to the marvelous tide of immigration that has characterized the State of Washington, and in particular that form of agriculture from which such large profits are today derived—fruit growing. Here mines of every description are being developed, and fisheries whose products travel as far east as the Atlantic seaboard. Those three concomitants of successful manufactures—materials, power, transportation—are all here, with the inevitable result of a great and rapidly increasing industrial activity. And here foreign commerce has grown to such proportions that Seattle is now contesting the first place on the Pacific with San Francisco.

Two streams particularly available for supplying hydroelectric power to this region are the Snoqualmie and White rivers. Of the two plants here mentioned, the Snoqualmie river has been harnessed for a number of years. It is owned and operated by the Seattle-Tacoma Power Co. The Pacific Coast Power Co. is the possesor of certain land and water rights essential to the development of power on the White river, within twenty miles of Seattle and fifteen miles of Tacoma. This company is preparing for an ultimate development of 80,000 horsepower from the White river, with a first development, at present under construction, of about 27,000 horsepower. The Snoqualmie plant has now 14,000 developed horsepower, and the development of 9000 additional horsepower is nearing completion. This power is distributed in Everett, Seattle and Tacoma. So rapid, however, is the increase in the demand in these cities and the surrounding country that the development of the water rights on the White river has become a matter of urgent necessity.

Water is to be diverted from White river into a storage basin of about 2,436,570,000 cubic feet capacity,

including the sheet known as Lake Tapps, and delivered at the turbine water wheels in the generating station on Stuck river, through steel penstocks under a head of 415 feet. The initial development will be about 27,000 horsepower, but the dam, canal, reservoir and forebay will be constructed to take care of the ultimate capacity of the plant, namely, in excess of 80,000 horsepower. Owing to the latter fact, the company will be able to make its future increases in generating capacity at a very reasonable cost.

That increases will be called for in the very near future, is beyond all doubt. The initial development of 27,000 horsepower will be completed by the fall of 1911, but this whole amount is in a fair way to be immediately absorbed, and the presumption is irresistable that an increase in generating capacity must follow without delay.

The condition in which the Pacific Coast Power Company finds itself, is, in fact, a very striking indication of the growth of community life in the Northwest, and particularly in the Puget Sound country. Empire building in that section of the United States is proceeding at a pace that precludes any rest on the part of those whose function it is to provide public utilities. In common parlance much is said about providing facilities for the future; as a matter of fact, the work of providing facilities for the present is taxing every energy.

CENSUS FIGURES ON ELECTRIC POWER.

According to the figures of the Bureau of the Census in 1902 the annual output of all electric stations and electric railways in the United States amounted to 4,768,535,512 kilowatt hours. In 1907 the output of the two classes of stations was 10,621,406,837 kilowatt hours, the increase in that year as compared with 1902 being 5,852,871,325 kilowatt hours, or 122.7 per cent. In 1902 the output by electric railways formed 47.4 per cent of the total, but by 1907 the proportion for such railways had fallen to 44.9 per cent.

The number of commercial and municipal plants increased from 3620 in 1902 to 4714 in 1907. the increase amounting to 1094 or 30.2 per cent. The application of the same rate of increase to the estimated number of isolated plants in 1902 gives an estimate of 65,000 for 1907. To what extent the utilization of surplus power in the operation of private electric plants to furnish light and power for large mills, department stores, hotels and other industrial enterprises has stimulated the increase in these plants it is, the report declares, impossible to state, and notice is given that the estimate, therefore, may be more or less than the actual number of isolated plants in existence.

Referring to power or generating plants, the report states that the number of primary power of generating plants was not called for in the schedule used for reporting central stations in 1907, but some idea of their number may be had from the fact that the returns showed 4731 plants equipped with dynamos for the generation of electricity. Of the 4,714 stations reported in 1907, 227 had no generating equipment, while 113 had more than one power plant. This latter class reported 357 generating stations.

There were, in 1907, according to the report, upward of 30,000 individuals, companies, corporations, and municipalities, exclusive of isolated electric plants, which reported the generation or utilization of electric current in what may be termed "commercial enterprises."

These industries represent an outstanding capitalization of $6,209,746,753, of which amount $1,367,338,836 is credited to central electric stations—$3,774,722,096 to electric railways, $814,616,004 to commercial or mutual telephone companies, and $253,019,817 to telegraph companies, the latter item including $32,726,242, the capital stock of wireless telegraph companies. The capitalization of the 17,702 independent farmer or rural telephone lines and of the 1157 electric police-patrol and fire-alarm systems could not be ascertained.

With regard to street railways, it was found in 1907 that car mileage had increased 41.4 per cent; there was a gain of 63.3 per cent in the total number of passengers; a rise of 55.9 per cent in the number of fare passengers; the number of companies increased 25.2 per cent; the trackage lengthened by 52.4 per cent; the gross income of the railways jumped 71.6 per cent; the amount of salaries and wages kept upward pace with the rest; and electricity practically superseded all other kinds of motive power.

CHINESE PIG FOR IRONDALE FURNACES.

In reporting the signing of a contract for the supply of Chinese pig iron and iron ore to an American concern by the Hanyang Iron and Steel Works, of Hankow, Vice-Consul Hubert G. Baugh gives the following details:

The contract calls for the shipment to the Western Steel Corporation, at Irondale, Washington, of at least 36,000 tons each of pig iron and iron ore annually for 15 years. At the option of the purchaser the shipments may be increased to 100,000 tons in a year. This Chinese ore is guaranteed 62 per cent pure, and the pig iron from it was quoted last December at $25 per ton, against $23 to $24.50 for English and Continental.

The total output of pig iron of the Hanyang works for 1909 was 74,000 tons. A new blast furnace to be started shortly will enable this to be doubled, but if the possible maximum of 100,000 tons is desired by the American Steel Company it can readily be seen that the larger part of the output of the Hanyang works will be exported. Exports to Shanghai and other Chinese ports amounted in 1909 to 16,800 tons, to Japan 23,700, to the United States 3800, a total of 44,300 tons.

The Robert Dollar Steamship Company will transport the ore and pig iron, and at least 12 trips a year will be necessary to carry the minimum amount. For this service one or two new steamers will immediately be constructed in the British Isles. Though these will fly the British flag they will be owned by American capitalists. It will require considerable freight to fill these vessels in the outward cargo, and this enterprise should help increase trade between the United States and China. The proposed trip next September of representatives of the Associated Chambers of Commerce of the Pacific Coast should further stimulate this commerce.

THE WATTHOUR METER.

BY WM. M. SHEPARD AND ALLEN G. JONES.

(Continued.)

CHAPTER VIII.

REPRESENTATIVE SCHEDULES OF RATES.

The Commonwealth Edison Co., of Chicago, Ill.

Schedule A.—Regular Lighting Rate.

The following is the regular rate for electricity for lighting purposes, or upon an interior distributing circuit carrying electricity for lighting and also for heating or power through the same meter, as measured by a meter or meters owned and installed by the company:

Thirteen cents (13c) per kilowatt hour for all electricity consumed in each month up to and including an amount that would be equal to thirty hours' use of the consumer's maximum demand in such month, and seven cents (7c) per kilowatt hour for all electricity consumed in such month in excess of that amount.

Maximum recording meters will be installed by the company for the purpose of ascertaining the maximum demand, except where the capacity of the consumer's installation is less than one kilowatt, in which case the maximum demand will be estimated.

A discount of one cent per kilowatt hour on the consumer's total monthly consumption will be allowed on monthly bills paid on or before ten days after their respective dates.

The rate stated in this schedule A covers and includes, for incandescent lighting, the free installation and use of the proper supply of incandescent lamps of the company's present standard carbon filament types, and of the same voltage, efficiency and candlepower as the incandescent lamps now furnished by the company.

An abatement or reduction of one-half cent (½c.) per kilowatt-hour from the aforesaid rate shall be allowed to a consumer furnishing, maintaining and renewing all the lamps or other forms of electric illuminants used by him.

Schedule B.—Regular Power Rate.

The following is the regular rate for electricity used for power purposes exclusively, as measured by a meter or meters owned and installed by the company:

Eleven cents (11c) per kilowatt hour for all electricity consumed in each month up to and including an amount that would be equal to thirty hours' use of the consumer's maximum demand in such month; and six cents (6c) per kilowatt hour for all electricity consumed in such month in excess of that amount.

When the electricity is taken from the company's direct current system, the greatest number of kilowatts used at one time (the peak of the load) in any month shall be deemed the maximum demand for such month; and maximum recording meters will be furnished by the company for the purpose of ascertaining the maximum demand, except where the capacity of the consumer's installation is less than one kilowatt, in which case the maximum demand will be estimated.

When the electricity is taken from the company's alternating current system, the maximum demand for any month shall be the number of kilowatts equal to a percentage of the total kilowatt capacity represented by all motors connected, which percentage shall be in accordance with the following table of percentages:

Where installations are under 10 horsepower, and only one motor is used 85%

Where installations are under 10 horsepower, and more than one motor is used 75%

Where installations are from 10 horsepower to 50 horsepower, both inclusive (irrespective of number of motors) 65%

Where installations are over 50 horsepower (irrespective of number of motors) 55%

The horsepower capacity of any alternating current motor or motors shall be assumed to be that which is indicated by the manufacturer's standard nominal rating or ratings; and each horsepower shall be deemed to be equal to seven hundred and forty-six watts. The company shall, however, have the right ,from time to time, to test any such motor or motors, and if it be found on any such test that the actual horsepower used by such motor or motors exceeds its or their rated capacity, the kilowatt equivalent of the maximum horsepower actually used shall constitute the consumer's maximum demand.

A discount of one cent (1c.) per kilowatt-hour on the consumer's total monthly consumption will be allowed on monthly bills paid on or before ten days after their respective dates.

The consumer shall pay to the company each month not less than fifty cents (50c.) per horsepower, or fraction thereof, in rated capacity of motor or motors connected.

Schedule C.—Wholesale Rates for Electricity.

Any consumer entering into a written contract to use the company's electricity for either lighting or power, or both, for a period of not less than five years in any single premises occupied by him, will, at his option, be given a wholesale rate for such premises, in lieu of the rates stated in Schedules A and D, which wholesale rate shall consist of both a primary and a secondary charge in accordance with the following specification of charges:

Direct Current.—Contract Without Guaranty.

Primary Charges.

For Each Month:

$3.20 per kilowatt of the consumer's maximum demand in such month up to and including 20 kilowatts.

$2.50 per kilowatt of the excess of the consumer's maximum demand in such month over 20 and up to and including 50 kilowatts.

$2.20 per kilowatt of the excess of the consumer's maximum demand in such month over 50 kilowatts.

Secondary Charges.

For Each Month:

6c per kilowatt-hour for the consumption in such month up to and including 2000 kilowatt hours.

3c per kilowatt-hour for the excess consumption in such month over 2000 and up to and including 5000 kilowatt hours.

1.4c per kilowatt-hour for the excess consumption in such month over 5000 kilowatt-hours.

Contract with Guaranty.

If the consumer will guarantee that his maximum demand in each year of the contract term shall be not less than 200 kilowatts, the following primary and secondary charges will be made:

Primary Charges.

$28.00 per kilowatt per year reckoned upon 200 kilowatts, the guaranteed maximum demand; and

$25.00 per kilowatt per year for the excess, if any, over 200 kilowatts of the consumer's actual maximum demand recorded in the year.

Such primary charges for each year to be paid by the consumer in installments as follows:

At the end of each month he shall pay $2.33 1-3 per kilowatt reckoned upon 200 kilowatts, and $2.08 1-3 per kilowatt for the excess, if any, over 200 kilowatts of the maximum demand recorded in the year previously to that time.

At the end of the year he shall pay the difference, if any, between the sum of the prescribed monthly installments for the year, and the amount constituting the full primary charge for the year.

Secondary Charges.

For Each Month:

6c per kilowatt-hour for consumption in such month up to and including 2000 kilowatt-hours.

3c per kilowatt-hour for the excess consumption in such month over 2000 and up to and including 5000 kilowatt-hours.

1.4c per kilowatt-hour for the excess consumption in such month over 5000 kilowatt-hours.

Alternating Current Transformed.—Contract Without Guaranty.

Primary Charges.

For Each Month:

$3.20 per kilowatt of the consumer's maximum demand in such month up to and including 20 kilowatts.

$2.20 per kilowatt of the excess of the consumer's maximum demand in such month over 20 and up to and including 50 kilowatts.

$2.00 per kilowatt of the excess of the consumer's maximum demand in such month over 50 kilowatts

Secondary Charges.

For Each Month:

6c per kilowatt-hour for the consumption in such month up to and including 2000 kilowatt-hours.

3c per kilowatt-hour for the excess consumption in such month over 2000 and up to and including 5000 kilowatt-hours.

1.1c per kilowatt-hour for the excess consumption in such month over 5000 and up to and including 30,000 kilowatt-hours.

.9c per kilowatt-hour for the excess consumption in such month over 30,000 kilowatt-hours.

Contract With Guaranty.

If the consumer will guarantee that his maximum demand in each year of the contract term shall be not less than 200 kilowatts, the following primary and secondary charges will be made:

Primary Charges.

$26.00 per kilowatt per year reckoned upon 200 kilowatts, the guaranteed maximum demand; and

$21.50 per kilowatt per year for the excess, if any, over 200 kilowatts of the consumer's actual maximum demand recorded in the year.

Such primary charges for each year to be paid by the consumer in installments as follows:

At the end of each month he shall pay $2.16 2-3 per kilowatt reckoned upon 200 kilowatts, and $1.75 1-6 per kilowatt for the excess, if any, over 200 kilowatts of the maximum demand recorded in the year previously to that time.

At the end of the year he shall pay the difference, if any, between the sum of the prescribed monthly installments for the year, and the amount constituting the full primary charge for the year.

Secondary Charges.

For Each Month:

6c per kilowatt for the consumption in such month up to and including 2000 kilowatt-hours.

3c per kilowatt-hour for the excess consumption in such month over 2000 and up to and including 5000 kilowatt-hours.

1.1c per kilowatt-hour for the excess consumption in such month over 5000 and up to and including 30,000 kilowatt-hours.

.9c per kilowatt-hour for the excess consumption in such month over 30,000 kilowatt hours.

Alternating Current Untransformed.—Contract With Guaranty.

If the consumer will guarantee that his maximum demand in each year of the contract term shall be not less than 200 kilowatts, the following primary and secondary charges will be made:

Primary Charges.

$25.00 per kilowatt per year reckoned upon 200 kilowatts, the guaranteed maximum demand; and

$20.50 per kilowatt per year for the excess, if any, over 200 kilowatts of the consumer's actual maximum demand recorded in the year.

Such primary charges for each year to be paid by the consumer in installments as follows:

At the end of each month he shall pay $2.08 1-3 per kilowatt reckoned upon 200 kilowatts, and $1.70 5-6 per kilowatt for the excess, if any, over 200 kilowatts of the maximum demand recorded in the year previously to that time.

At the end of the year he shall pay the difference, if any, between the sum of the prescribed monthly installments for the year, and the amount constituting the full primary charge for the year.

Secondary Charges.

For Each Month:

6c per kilowatt-hour for the consumption in such month up to and including 2000 kilowatt-hours.

2.7c per kilowatt-hour for the excess consumption in such month over 2000 and up to and including 5000 kilowatt-hours.

1c per kilowatt-hour for the excess consumption in such month over 5000 and up to and including 30,000 kilowatt hours.

.8c per kilowatt-hour for the excess consumption in such month over 30,000 kilowatt-hours.

Bills for both primary and secondary charges will be rendered monthly and a discount of ten per cent. (10%) upon the secondary charges will be allowed on all bills paid on or before ten days after their respective dates.

Schedule U.—Automobile Charging in Private Garages.

The rate for electricity for charging automobiles in private garages is either the regular power rate specified in Schedule B, or the power rate under contract for one year or longer specified in Schedule D as the consumer may prefer, subject, however, to the following additional provisions:

The net minimum charge to be paid by the consumer each month shall be not less than sixty-six and two-thirds cents (66 2-3c) for each kilowatt of the consumer's maximum demand in such month, and no monthly bill shall be less than one dollar and fifty cents ($1.50). Where alternating current charging boards are used no monthly bill shall be less than one dollar and fifty cents ($1.50) for each charging board.

Schedule V.—Automobile Charging in Public Garages.

The rate for electricity for charging automobiles in public garages is either the regular power rate specified in Schedule B, or the power rate under contract for one year or longer, specified in Schedule D, as the consumer may prefer, subject, however, to the following additional privisions:

If the consumer agrees not to make use of the company's service for this purpose during the two hours of the day between four and six o'clock P. M., his net rate for electricity

furnished for charging automobiles shall not exceed five cents (5c.) per kilowatt-hour.

Where alternating current charging boards are used no monthly bill shall be less than one dollar and fifty cents ($1.50) for each charging board.

Schedule W.—Rates for "Throw-Over" Switch Service.

Where a consumer's premises are supplied with electricity either for light or power, or both, from some plant in the building in which the premises are situated (whether such plant belongs to the consumer or not), and such consumer desires to be in a position to use, or in fact uses, the company's electrical service, not regularly but only occasionally and during the temporary break-down or cessation of such plant; or where a consumer's premises are supplied with power of any kind from any plant in the building in which the premises are situated (whether such plant be an electric plant or not, or be owned by the consumer or not), and such consumer desires to be in a position to use, or in fact uses, the company's electrical power service, not regularly but only occasionally and during the temporary bread-down or cessation of such plant, the consumer will be charged and must pay to the company for such emergency service the rate hereinafter in this schedule provided, to-wit:

Such rate will be that specified in Schedule A. D. or E, according to the purpose for which the service is used, with the additional requirement that the consumer shall pay, irrespective of the amount of his consumption, a minimum monthly charge depending upon the number and capacity of lamps, motors and other apparatus arranged for connection with the company's service, which charge shall be in accordance with the following table of minimum charges:

For each incandescent lamp so connected, ten cents (10c) per month where the lamp has a capacity of fifty (50) watts or less, at rated voltage, and at the rate of ten cents (10c) per month for fifty (50) watts of capacity where the lamp has a capacity exceeding fifty (50) watts.

For each arc lamp so connected one dollar ($1.00) per month where the lamp has a capacity of five hundred (500) watts or less, at rated voltage, and at the rate of one dollar ($1.00) per month for five hundred (500) watts of capacity where the lamp has a capacity exceeding five hundred (500) watts.

For each motor so connected, other than a motor used for operating elevators, hoists or similar machinery, one dollar and fifty cents ($1.50) per month per rated horsepower of such motor.

For each motor so connected used for operating elevators, hoists or similar machinery, five dollars ($5.00) per month per rated horsepower of such motor.

The company will furnish emergency service under this schedule only when the premises are situated on its existing lines having the requisite capacity, and only when the consumer signs a contract for the service, running for one year or longer and specifying the number and capacity of lamps, motors or other electrical apparatus in his premises that are to be supplied with the company's electricity during such occasional periods and providing that the consumer shall so arrange his wiring that no lamps, motors or apparatus other than those specified in the contract can be thrown on the company's service by means of switches, or otherwise. For the purpose of this service the company will enter its service main into the building in which the consumer's premises are situated (providing the consumer, in case he shall not own the building, shall obtain the necessary consent from the owner), and the consumer must, at his own expense, install switches and such other equipment as may be necessary for connecting his premises with such service main at the point of entry into the building. For service under this schedule the company will not furnish lamps or renewals for the same.

(To be continued.)

HISTORY OF THE STOCKTON WATER COMPANY.

BY J. W. HALL,

The growth of the Stockton waterworks, now owned by the Pacific Gas and Electric Company, forms an interesting record of an increasing water supply gained from the sinking and operation of a large number of deep wells to keep pace with the development of a city having a population of 25,000.

When primitive man abandoned the nomadic habit, which is still manifest in some Asiatic tribes and in the life of gypsies, he naturally settled down close to a water supply; and near to streams grew the earliest communities. As towns arose and covered a wider area immediate access to the stream became more difficult for the distant house-holders, and out of this condition grew the necessity for and the development of systems for delivering water through ditches. The drying up of the closest streams after long seasons of drought, the increase of population, and the constantly growing demands for more water for other than ordinary domestic uses produced conditions that, in time, brought about the splendid stone reservoirs, aqueducts, and surface-delivery systems that reached a wonderful condition even 2,000 years ago for the city of Rome, where many of the original constructions are still extant.

With the development of civilization and the growth of modern cities more and more water has been required for the industries, for fire protection, for irrigation, and for domestic purposes. And wherever there is a natural demand for anything, that thing becomes worth something and salable, and inventive and ingenious man arises with projects for furnishing a supply and reaping the financial reward. Thus it is that man and corporations and cities themselves have gone far afield in search of a water source for growing communities that promised to require much more than was immediately available.

In California, owing to its peculiar climatic conditions and the cessation of rain during practically the whole summer period from the first of April to the first of October, the conservation of water has become a paramount principle governing the growth of the state. At times it has been impossible to supply enough water to the inhabitants of some congested centres of population. During a protracted dry season following a period of comparatively light snows on the mountains many of the streams have almost entirely disappeared, but generally below the beds of some of them have percolated water at a great depth. In some places wells sunk deep enough to tap these subterranean supplies have found water with sufficient pressure to bring it bubbling up and overflowing above the surface of the earth. These are artesian wells.

Stockton, although situated on the San Joaquin, one of the two great rivers of the State, cannot use river water for household purposes because it is brackish from the backing up of the high tides of San Francisco bay. When Stockton became the centre of distribution for supplies to the great mines along the mother lode then the necessity arose for obtaining a large supply of water for domestic purposes and for

fire protection, because the future of the town was assured. Deep wells were sunk and an artesian flow was secured, and the expansion of this principle is the basis of Stockton's supply.

The history of the Stockton Water Company covers a period of half a century. In 1859, ten years after the first wild rush of goldseekers into California, P. E. Connor made a contract with the town of Stockton and the county of San Joaquin whereby for a period of twenty years he was to have the use of wells owned by the town on a certain lot, was to pay $10 a month rental for the lot with the privilege of purchase, and was to supply the town and county's needs of water for a consideration of $700 a year. This arrangement was the beginning of the water company that gave Stockton a supply that its citizens could obtain as regular customers of the company. But it was not until August of 1867 that the company was incorporated, and then its capital stock appeared as $100,000, and it had a franchise that would run fifty years. Evidently O'Connor bought the lot from the city, because the records show that a few days after the incorporation papers were filed he deeded the lot to the Stockton Water Works Company, which was practically owned by L. L. Bradbury and wife of Los Angeles. The Bradburys retained possession until 1891, when they sold everything but the lot to the present Stockton Water Company.

This Stockton Water Company was organized in October of 1890, with W. S. McMurtry of Los Gatos, W. S. McMurtry, Jr., of San Francisco, John Flournoy of San Francisco, C. T. Ryland of San Jose and R. D. Murphy of San Jose as its incorporators. A twenty-five-year franchise was obtained, and it will expire November 25, 1915. In 1895 the Blue Lakes Water Company secured a controlling interest in the stock, and in 1908 legal title to the system. In 1904 the property was absorbed by the California Gas and Electric Corporation, and in 1908 it was transferred to the title of the Pacific Gas and Electric Company.

In 1884, during the Bradbury ownership, pumping from the city lot was abandoned, because in 1882 and 1884 some lots had been bought east of Stockton, and deeper and better wells were sunk on them. The first of these deep wells flowed originally 10,000 gallons an hour and the second 5000 gallons an hour, and they continued thus to flow into a surface reservoir in lessening volume until 1889, when they ceased altogether. Since 1889 there has been no flowing water from any of the wells. Pumps have been necessary.

In 1891 the Stockton Water Company issued $350,000 in bonds, running twenty years and bearing 6 per cent interest, and with this capital started a system of cast iron mains. Shortly before this the city of Stockton had bonded itself and laid four miles of mains for fire protection purposes and with the intention of getting its own water supply. But the water company leased the city's new mains, and in consideration of the use of them agreed to supply free water for fire protection.

The company paid dividends from 1891 to 1898, and then, because the city council, voicing the hostility of the people, had cut down the rate schedule about 35 per cent, there was so little revenue that no dividends were possible, and for a time there was not sufficient for the payment of the interest on the bonds. But since that period of depression the rates, after strenuous efforts annually applied, have been raised slightly four different times until in 1909 by close economy and the help of the natural increase in business a fair earning capacity has been attained. But ever since 1898 all surplus earnings have been put back into improvements of the system.

When, in 1891, the Stockton Water Company took control there were approximately 800 consumers' accounts. In July of 1909 there were 4,181 individual accounts of consumers, 229 fire hydrants, 309 sewer flushers, and forty-five miles of street mains from twenty-inch down to four-inch diameter.

The daily output of water in July and August is now about 4,500,000 gallons, and in December and January, about 1,800,000 gallons. The average per capita consumption for the 25,000 population the year round is 109 gallons a day.

Because domestic water is easily obtainable in Stockton at a depth of seventy feet the company has had an uphill fight against the competition of private wells and windmills over a scattered community. An inadequate company service in earlier years created public resentment. But under the present corporate control and its adequate financial backing it has been possible to produce a first-class service and a capacity that has anticipated the future needs of the city. This good service, coupled with reasonable rates, has abated and removed the old antagonisms and made the company's service so popular that no new windmills have been constructed within the area of the company's system and the old ones are rapidly becoming disused.

The wells furnishing Stockton's supply of water, their depth, when they are bored, and the size of the casing are all shown in the accompanying table:

At Pumping Station No. 1.

Deep Well.	Bored.	Depth in feet.	Size of Piping in inches.
1st	1882	1,100	8 (below 800 ft., 7-in.)
2d	1884	960	6 (below 650 ft., 5-in.)
3d	1885	1,040	8
4th	1891	560	10
5th	1895	218	8
6th	1895	218	8
7th	1895	300	8
8th	1895	577	8
9th	1900	770	12
10th	1902	223	20
11th	1906	950	12
12th	1907	1,002	14 (below 268 ft., 12-in.)
13th	1908-9	1.050	14 (below 250 ft., 12-in.)
At Pumping Station No. 2.			
1st	1903	667	12 (below 632 ft., 10-in.)
2d	1904	807	12 (below 594 ft., 10-in.)
3d	1909	960	14 (below 260 ft., 12-in.)
4th	1909	(boring)	14

Wireless telegraphy from airships by means of the new Telefunken singing spark system has proved satisfactory on some of the Zeppelin airships in Germany, which easily maintain communication with land stations for distances of over thirty miles.

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POWER AND GAS

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Lighting Rates and Costs

The choice of a proper charge for electric lighting is a vital question to central stations. The commercial success of the high-efficiency lamp prematurely forced this issue, inevitable either from competition or governmental regulation. In some cases the service charges made by a new company have proved too low, while there are others correspondingly too high. It is now possible to so predetermine costs that rate-fixing is no longer a matter of guess-work or an arbitrary levy of all that the traffic will bear. It consequently behooves every power company to carefully analyze its costs so as to properly synthesize its rates.

One of the best proposals for such an analysis is contained in a paper read by S. E. Doane before the recent St. Louis convention of the National Electric Light Association. This paper is primarily concerned with the effect of high-efficiency lamps on central station costs. The author has segregated all cost items, such as general expense, generating and distributing expense, taxes, insurance, depreciation, interest and dividends, under the three heads of "output," "demand" and "consumers." The relative proportion of each of these cost items which is in any way affected by increasing the number of kilowatt-hours generated, without increasing the plant's capacity, is listed under "output"; the percentage charged to "demand" represents the cost dependent upon the station's capacity; the portion assigned to "consumers" is that part which is increased or decreased with change in the number of consumers connected. Taking an average for a large number of stations throughout the country, Mr. Doane allots 14.6 per cent to "consumers," 30.3 per cent to "output" and 55.1 per cent to "demand." As these figures are but averages and necessarily vary with each company studied, they may be easily remembered as a geometrical progression of approximately 1/7, 2/7 and 4/7 respectively.

A local application is interesting. In the present rate war between the Edison company and the municipal plant at Pasadena, California, the officials of the latter are quoted as saying that current can be profitably sold at five cents per kilowatt-hour, provided the number of customers is increased from 2135 to 4000, the former rate being seven cents. Assume that the number of kilowatt-hours generated increases in the same ratio as the number of customers, 7/8, and that no increase in station capacity is necessary. Then that proportion of the expense due to new consumers becomes $1/7 \times 7/8 = 1/8$ increase, that due to increased output is $2/7 \times 7/8 = 1/4$ increase, a total of 3/8, there being no "demand" increase. The income from 4000 consumers at 5/7 the former rate to 2135 consumers, assuming like consumption, is 1/3 greater, $3/8 - 1/3$ thus showing a slight loss. This apparent loss is undoubtedly due to conditions at Pasadena which would reduce the cost factors we have employed merely to emphasize the general applicability of the method which is a good start in the right direction of basing rates on costs.

PERSONALS.

Francis E. Wilkinson of New York and London is visiting San Francisco as a guest of Leo D. Haas.

K. G. Dunn, engineer with Hunt, Mirk & Co., of San Francisco, left last week for an extensive Eastern trip.

R. Holterman of the Holabird-Reynolds Company has returned from Seattle, where his firm has a branch house.

P. M. Downing and S. J. Lisberger of the Pacific Gas & Electric Company have returned from a trip to Chicago.

C. Eccles, manager for Eccles & Smith, an electric railway company in Los Angeles, is a San Francisco visitor.

Frank Morse, manager of the Coquille River Electric Company of Coquille, Ore., was a recent arrival at San Francisco.

R. C. Gillis has been elected president of the Los Angeles-Pacific Company, Los Angeles, Cal., to succeed E. P. Clark, resigned.

F. H. Poss, manager of the San Francisco office of the Benjamin Electric Mfg. Co., left this week for a two months' trip east.

J. H. McDougal has joined the commercial department of the Pacific Gas & Electric Company under S. V. Walton at the main office.

R. S. Buck, an electrical engineer with Sanderson & Porter, has returned to New York after spending several months on the Pacific Coast.

J. J. Von Dohlen, fiscal agent of the Canadian Electric Water Heater Company, has arrived from Vancouver, B. C., on his way to New York.

Edward Whalley of the Northern California Power Company's main office has returned after visiting the company's power plants in Shasta County.

P. H. Coolidge, assistant general manager, and F. C. Phelps, auditor of the Pacific Telephone & Telegraph Company, recently visited Los Angeles.

A. E. Wieland, formerly of the Entiat Light & Power Company, and Walter Thomas have opened offices as irrigation engineers at Wenatchee, Wash.

V. W. Shear, engineer of the turbo-generator department of the Westinghouse Electric & Mfg. Co., is making a tour of the company's Pacific Coast district offices.

W. W. Briggs, Pacific Coast district manager of the Westinghouse Electric Manufacturing Company, has returned from a trip to Pittsburg after an absence of several weeks.

N. A. Carle has opened an engineering office at No. 510 Central Building, Seattle, Wash., and is prepared to do consulting and constructing work in mechanical, electrical and mining engineering.

J. M. Yount has resigned as master mechanic of the Union Railway, New York, N. Y., to become master mechanic of the United Railroads, San Francisco, Cal., to succeed Mr. F. F. Bodler, resigned.

Lee De Forest arrived at San Francisco last week to install a De Forest wireless telegraph plant on the United States transport Buford. The radiotone sparkless type of apparatus is being installed.

Herman R. Erkes has resigned as purchasing agent for the Ventura County Power Company, Oxnard, Cal., to assume similar duties for Bailie & Brandt Co., machinery merchants and engineers of Los Angeles, Cal.

J. A. Murray, commercial manager of the Pacific Telephone & Telegraph Company's office at Roseburg, Ore., was recently transferred to Everett, Wash., as manager, being succeeded by W. C. Mumaw of Seattle.

Ely C. Hutchinson, commercial engineer for the Pelton Water Wheel Company, will leave next week for an extended tour of the Pacific Northwest in connection with pending contracts that are to be placed with his company.

E. G. Dewald, who was for several years Pacific Coast representative of the Platt Iron Works Company and more recently with the Allis-Chalmers Company, will, on July 1st, join the sales force of the Pelton Water Wheel Company.

H. M. Adams, general freight and passenger agent of the Spokane, Portland & Seattle Railway, Oregon electric railway and United Railways, at Portland, announces his resignation from those positions to accept the post of general freight agent of the Western Pacific road, with offices at San Francisco.

J. A. Vandergrift, manager of the Oakland Warehouse Company, left this week to attend the annual conference of the branch managers of the National Electric Lamp Association, to be held at Association Island during the week of June 19th to 25th, and also to attend the summer meeting of the Licensed Association of Lamp Manufacturers, to be held at Association Island during the week of June 26th to July 2d.

H. H. Noble, president of the Northern California Power Company, has returned from Shasta county after witnessing the starting up of the Inskip power station on Battle Creek.

TRADE NOTES.

Hunt, Mirk & Co., representing the Westinghouse Machine Company on the Pacific Coast, have closed contracts with the Southside Light & Power Company of San Francisco for a Westinghouse-Parsons turbo-generator with a capacity of 1000 kw. and for the laying of conduits for a steam exhaust-heating system. The plant will be installed in a re-inforced concrete building to be erected on Minna street, adjoining the Rialto Building, on whose roof the cooling tower will be placed.

B. F. Kierulff, Jr. & Co. of Los Angeles, have been appointed representatives of the Mott Iron Works of New York City, manufacturers of ornamental light posts and fixtures, the Jefferson Union Co. of Lexington, Mass., manufacturers of pipe unions and joints, the Sprague Electric Company of New York, motor generators, and flexible steel armored steam and air hose and the Atlantic insulated Wire Company of New York.

Sanderson & Porter report the 100,000-volt power transmission of the Sierra & San Francisco Power Company from the Stanislaus river, has been started and that power is now being delivered in San Francisco to the United Railroads regularly. This power is being used at the Bryant avenue, Geneva avenue, and Millbrae sub-stations, being all 60 cycle current at 12,000 volts. The operation of the Bay Shore substation as well as the rest of the United Railroads sub-stations, is in charge of Mr. Bivins, superintendent of electrical equipment of the United Railroads. Although this is the latest transmission system to reach San Francisco it is the shortest, the length of pole line being 135 miles as against 148 miles for the nearest competitor.

MEETING OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

The tenth annual convention of the National Electrical Contractors' Association will be held in Atlantic City, New York, July 20, 21 and 22, 1910. An interesting program of papers and many attractive features of entertainment have been provided, as it is hoped to make it the largest and most interesting convention held by this organization.

OBITUARY.

Frank E. Corwin died at his home in Oakland, California this week, the funeral being held on June 16th from his late residence. Mr. Corwin was recently compelled to give up the management of the Pacific Coast office of the Bryant Electric Company on account of his illness.

INDUSTRIAL

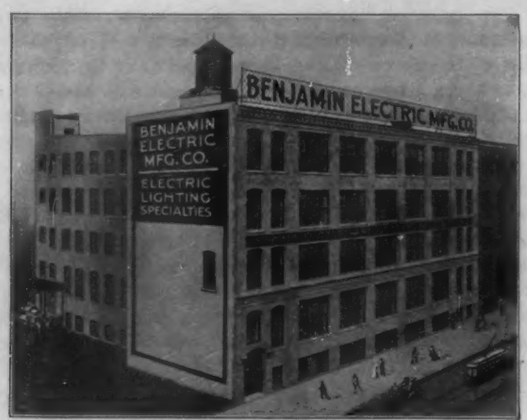
THE BENJAMIN PARABOLITE.

The Parabolite is a new fixture of the Benjamin Electric Manufacturing Company of Chicago, for street lighting with Series Mazda Lamps. By means of a porcelain enameled steel reflector composed of four intersecting semi-parabolas surrounding the lamp, the greater portion of light is projected down the center of the street, and only the necessary minimum amount is allowed to reach the street corners. As a result the light secured for the street proper is increased more than 50 per cent as compared with the usual amount when allowed to radiate over 360 degrees. Where it is desirable to suspend the fixture in the center of the block, reflector with two (2) instead of four (4) semi-parabolas is furnished.

Benjamin Parabolite.

The body of the device is composed of a porcelain base forming the main part of the socket, and integrally formed knobs. This base is supported by an iron fitting attached by four screws. The fitting in turn is covered by a porcelain petticoat insulator, which is held in position by a metal bushing screwed into the supporting casting.

The porcelain knobs are located as nearly as possible in line with the bottom of the metal supporting flange. The strain of the wires has therefore little or no leverage, and



New Chicago House of Benjamin Electric Mfg. Co.

the danger of breaking the insulator is thus lessened. The binding plates are well protected, and are readily accessible.

The socket is provided with a spring center contact serving as short-circuiting device when the lamp is removed or accidentally loosened. It thus prevents the film from being punctured except when the lamp filament is broken. A heavy porcelain ring carrying the threaded socket shell and film cut-out is connected with the main socket by means of a bayonet snap lock, and can only be removed by pulling the porcelain downward and turning it to the left. The strain of placing or removing the lamp cannot unlock connections.

WESTERN ELECTRIC NEW DESIGN SIGNALING SYSTEM FOR MINES.

The Western Electric Company announces that it is prepared to furnish a new design of emergency signaling apparatus for mines which complies fully with the laws of Illinois and other States regulating the use of telephones and emergency signaling system in mines. The new signaling system consists of a generator signaling set and the regulation emergency eight-inch signal bells or gongs. The generators used in the signaling sets are designed in two sizes to accommodate systems which require a large or small equipment of gongs.

The smaller of the two generator equipments consists of a five-bar magnet generator mounted in an iron case, as shown in Fig 1. In appearance this case is similar to that of the new mine telephone set which the Western Electric Company placed on the market a few months ago. This five-bar generator will operate the equivalent of twenty-eight-inch, loud-ringing extension bells over eight miles of full metallic

Fig. 1.

No. 12 B. W. G. iron wire. The magnets of the generator are of the highest grade magnet steel and are hardened and aged to insure retaining their strength indefinitely. The bearings are large and well proportioned and the crank furnished is of a design which enables the generator to be rung easily when fully loaded.

The larger signaling set consists of a fourteen-bar magnet generator mounted in a metal case similar to that of the five-bar magnet equipment and is similar to that equipment in every detail except size. This generator will ring the equivalent of sixty eight-inch gong emergency bells over an eight mile line.

In each of these types the generator is arranged in an iron box provided with a padlock, ordinarily to be kept locked. To protect the generator when the outer door of the box is opened, a steel cover is fastened over the opening of the box and in front of the generator. This cover removes the possibility of any part of the clothing of the party operating the generator being caught in the generator wheels and also protects the generator from interference by other foreign substances which might collect should it be exposed while the door is open.

A compartment in the front of the door of the box equipped with a glass front is provided for the key to the set. It is the intention that a key to the set shall always be kept in this compartment and that this key will be used only in cases of emergency, when anyone may break the glass front and obtain the key to open the set. This compartment is to be made air-tight so that it will be impossible for dust to get inside and hide the key from view. The back of this com-

partment is to be painted white so as to make the key more noticeable.

It is also intended that the foreman or man in charge of the mine shall be provided with an extra key to enable him to open the box under ordinary conditions in the mine when it is desirable to operate the generator for fire or emergency call drill.

The same precaution against water following the line wires into the case of the signaling set is taken as in the Western Electric new design of mine telephone. The curved inlet at the top provides an entrance which removes the possibility of water flowing along the line wires and into the set.

The emergency signal bell used with the generators consists of a non-sparking bell provided with two eight-inch steel gongs mounted upon a wooden or steel backboard and having a protesting canopy. The gongs are not galvanized and have an especially loud and clear tone. All parts, including the windings, are specially treated to stand conditions of mining atmosphere.

Signalling Apparatus for Mines.

The signal system above described may be used with or independent of a telephone system. For mine telephone service the Western Electric Company has new designs of metal and wood sets and also a new design of an inter-communicating metal mine set, all of which are fully up to the standard of the telephone apparatus furnished to the telephone companies in the "Bell" system, who are its principal customers.

WESTINGHOUSE REPORT TO STOCKHOLDERS.

The annual meeting of the stockholders of the Westinghouse Machine Company for the election of directors and for the transaction of such other business as may properly be brought before the meeting, will be held in the general office of the company in East Pittsburg, on Tuesday, June 21, 1910,

Messrs. Haskins & Sells, certified public accountants, have made an examination of the books and accounts and have certified to the balance sheet as of March 31, 1910, the close of the fiscal year, and to the earnings of the company during the eight years ending that date. The following is an extract from their report:

Average annual net income available for interest and dividends, or for capital accounts for the eight years ended March 31, 1910.....$720,543.78

Average annual net income available for interest and dividends, or for capital accounts, for the five years ended March 31, 1910..... 736,719.05

Average annual net income available for interests and dividends, or for capital accounts, for the period from April 1, 1903, to March 31, 1910, exclusive of the years ended March 31, 1908 and 1909 ..... 841,149.86

The two fiscal years eliminated cover a period of general business depression and of the receivership and reorganization of the company.

New income available for interest and dividends, or for capital accounts, for the year ended March 31, 1910 . . . . 875,845.33

Net income available for interest and dividends, or for capital accounts, for the quarter ended March 31, 1910, $330,286.38, or at the rate per annum of$1,321,145.52

It is of interest to note that the orders received for shop product during the fiscal year just closed, ending March 31, 1910, aggregated $5,125,612.52, an increase of $2,322,536.88, or 83 per cent, as compared with $2,801,075.64 during the previous fiscal year; that the billing in shop product for the fiscal year amounted to $4,065,618.74, an increase of $1,309,912.94, or 48 per cent, as compared with $2,755,705.80 during the previous year; and that the net addition to surplus after deducting depreciation and interest charges (excluding the amount written off for an investment in a subsidiary company manufacturing storage batteries which was liquidated during the year) is $429,566.61, as compared with a loss of $228,123.54 during the previous year, a betterment over the previous year of $657,690.15.

NEW CATALOGUES.

The advantages of J-M Fibre Conduit are briefly detailed in an illustrated booklet from H. W. Johns-Manville Co.

Bulletin No. 390 from the National Brake and Electric Company of Milwaukee, Wis., is devoted to National pneumatic motor governors for electric railways.

The Linton Machine Co., 26 Cortlandt Street, New York, have published an illustrated description of the Komo steam trap for the separation of the water of condensation from steam.

The Carb-Ox Company, Rogers Park, Chicago, Ill., have issued an interesting catalogue of portable instruments for gas analysis and gas sampling by the Hays method. This apparatus enables the power producer to work out the highest economies in the use of fuel, whether coal, oil, gas or refuse.

Bulletin No. 4727 illustrates and describes two types of the General Electric Company's sewing machine motors which may be easily applied to any of the standard sewing machines of either drop head or stationary head types. These motors are intended for ordinary domestic use, and are made for alternating and direct current of standard voltages.

H. W. Johns-Manville Company have issued the first number of the J-M Roofing Salesman, which will be issued on the 28th of every month in behalf of J-M roofings and allied J-M building materials. This is a companion publication to The J-M Packing Expert, which is mailed on the 14th of every month to engineers and others interested in highest grade packings.

The General Electric Company has recently issued their Bulletin, No. 4737, illustrating and describing an Electric Hardening Furnace designed for the hardening or tempering of tool steel. In the operation of this furnace, metallic salts are brought to a liquid state by passing electric current through them, and the heating of the tool to be hardened can be exactly controlled and kept uniform throughout over a wide range of temperature.

Bulletin No. 4738, entitled "Belt Driven Revolving Armature Alternators," has been issued by the General Electric Company, and describes three sizes of polyphase, 60-cycle generators for use in small isolated plants. These generators are of the belt driven revolving armature type, and are designed for service at any power factor between .8 and 1.0. They range in capacity from 7½ to 25 kilowatts, and are furnished for 120, 240, 480 and 600 volts.

NEWS NOTES

INCORPORATIONS.

GREAT FALLS, MONT.—The Great Falls Power Company has been organized by C. F. Kelly of Butte et al. with a capital stock of $15,000,000.

ASOTIN, WASH.—The Grand Ronde Power Company has been incorporated for $1,000,000 and an authorized bond issue of $2,000,000. Power to the extent of 10,000 h.p. will be developed on the Grand Ronde.

LOS ANGELES, CAL.—The Sunland Rural Telephone Company has been incorporated by Philip Begue, C. B. Johnson, W. H. Mears, J. L. Hauber and W. B. Blumfield, all of Los Angeles, with a capital stock of $10,000.

TRANSMISSION.

PE ELL, WASH.—The Central Power Company has started work on its dam across the Columbia river at this place.

GRANGEVILLE, IDAHO.—The Big Bend Light & Power Company will increase the capacity of its plant and extend the service to Cottonwood.

EVERETT, WASH.—The Northwest Light & Power Company is planning to increase the capacity of the local plant from 60,000 to 1,000,000 feet of gas daily.

EUGENE, ORE.—Ball & Wilson received the contract for constructing the heating plant to be constructed for the Eugene Heating & Power Company, at $2100.

PEAVINE, NEV.—Surveyors are at work here, employed by the Loon Lake Water & Power Company, preparatory to erecting an hydroelectric power plant on the Rubicon river.

GOLD HILL, ORE.—B. H. Harris, president of the Gold Hill Railroad & Lumber Company, will either put in a power plant in Gold Hill on the Rogue river, or bring power from Butte Falls.

PORT TOWNSEND, WASH.—The Olympia Power & Transmission Company, a corporation capitalized at $1,000,000, with George A. Glines of Winnipeg and Thomas J. Aldwell as organizers, has completed plans for the building of a power line from the Elwah river to this city.

WALLA WALLA, WASH.—The Columbia Power & Light Company, of Portland is in the market for poles, cross-arms and pins for a 45-mile, 66,000-volt line from Walla Walla to Pasco, Washington. Construction will begin immediately, the County Commissioners having granted a fifty-year franchise. The Snake river will be crossed near Pasco by means of a 1600-foot span on steel towers.

TRANSPORTATION.

NORTH BEND, ORE.—The City Council has granted a franchise to the Coos Bay Rapid Transit Company for an electric line.

ALBANY, ORE.—It is reported that the construction of the Oregon Electric Line from Salem to this place will be started at once.

VICTORIA, B. C.—The British Columbia Electric Railway Company will extend its system on Vancouver Island through the Saanich peninsula.

PORTLAND, ORE.—The Mt. Hood Railway, Light & Power Company has secured right of way from Gresham to Portland. It is reported that active work will start this summer.

EUGENE, ORE.—Engineer F. B. Kidder of the Asset Company has gone to Coos Bay to start preliminary work on the proposed electric line from that place to Eugene.

VANCOUVER, WASH.—The Clark County Railway Company is planning the extension of an interurban line from here to the townsite of Sifton, a distance of five miles.

PALO ALTO, CAL.—F. E. Chapin, of the Peninsula Railway, formally announces that the construction of the line from Mayfield through the Stanford estate to San Mateo is to be started in the near future. He states that satisfactory arrangements have been concluded with the University authorities for the right of way on the Stanford estate.

SEATTLE, WASH.—The Bainbridge Development Company, M. B. Jackson, Jr., president, Bailey building, has secured a franchise from the commissioners of Kitsap county for the construction of electric railway lines from Eagle Harbor to Port Madison, Eagle Harbor to Manzanito and Eagle Harbor to Port Blakeley and Pleasant Beach, a total of 28 miles, to be operated in connection with a ferry service to Seattle.

BERKELEY, CAL.—Surveyors for the Oakland Traction Company are laying out the profile of the proposed Euclid avenue car-line extension from University and Shattuck avenues, to the end of Euclid avenue in the Wheeler tract. The franchise, as applied for, will be granted June 19, and the work of construction will commence immediately after. Owing to the heavy grades from Hilgard street north, low geared cars with high-powered motors will be necessary.

SAN FRANCISCO, CAL.—Seventy thousand dollars has been invested in a suburban railroad 70 miles in length which is to be built from Niles and to connect with Redwood City across the bay, taking in Dumbarton Point on the way. The project took legal shape when articles of incorporation were filed under the name of the San Francisco and Transbay Railroad Company. A million and a half of capital is authorized, though the stock actually subscribed, amounts to but $70,000. Of this $60,600 stands in the name of Attorney H. H. McClosky. The other incorporators, nominally are: E. Schnulenhaus, J. Comerford, A. Mulverhill and L. Block. Besides the main line from Niles to Dumbarton Point and crossing the bay with connections to Redwood and Woodside through San Francisco, a branch is to run from Redwood to Woodside, and from Dumbarton to Warm Springs.

OAKLAND, CAL.—The wharves and waterfront committee of the City Council has recommended the passage of an ordinance to grant to the San Francisco, Oakland and San Jose Railway a franchise for 1000 feet of wharfage space on the western waterfront. The strip includes the existing Key Route pier, for which no franchise was ever granted. Several amendments of utmost importance were written into the ordinance. The chief one was suggested by President Pendleton of the Council. It provides that the city may, with the consent of the War Department, extend the bulkhead line 2000 feet west of the low-tide line of 1852. This will give the city 206 acres to be filled with solid earth, thus creating waterfront land which Pendleton maintains would immediately be worth $12,500 an acre. The ordinance, if passed, will guarantee to the company fairways of 1000 feet on each side of its proposed grant. The company agrees to deed back to the city all wharfing-out rights it claims in the Key Route basin; to dedicate extensions of Seventh, Fourteenth and Twenty-second streets, through its tide lands to the low tide line, and to pay the city a rental of $75,000 during the 50 years' term of the franchise.

ILLUMINATION.

OLYMPIA, WASH.—The City Council has granted a new 40-year franchise to the Olympia Gas Company.

SAYULA, MEX.—This place will soon have an electric lighting plant, operated by a gas producing apparatus and engine.

GOLDFIELD, NEV.—The Hydro-Electric Company of Bodie is preparing to construct a power line into Rawhide to supply that camp with power and light.

WILLOWS, CAL.—The Northern Electric Power Company has given official information that it will soon construct a gas works in Willows to supply gas for light and heating.

MESA, ARIZ.—The contract for the erecting of a plant for the South Side Gas Company, on the property north of the N. & P. station, was let to L. E. C. Smith. The building will be 40x80 feet.

MARSHFIELD, ORE.— R. M. Jennings, the general manager and treasurer of the Coos Bay Gas & Electric Company, has announced that the company will make improvements to its gas plant to cost $200,000.

LOS ANGELES, CAL.—During the summer an electric lighting system extending from the Sunset Boulevard to the Bungalow Land in Laurel Canyon will be installed by the owners of the Lookout Mountain Bungalow Land and C. F. Harper.

EUGENE, ORE.—The Byllesby Company, owners of the Eugene Electric Light & Gas plants, has announced that it will spend $230,000, in improvements in and about Eugene. tI will rebuild the Eugene gas works and several miles of mains throughout the city.

OLYMPIA, WASH.—O. K. Thompson has filed on a water right in Yelm creek for the purpose of operating an electrical power plant. The site is about three miles northeast of Yelm and near the town of McKenna so that either town can be supplied with light and power.

SAN DIEGO, CAL.—The electric lighting system at Fort Rosenecranz which is located near San Diego, California, has been connected with the transmission lines of the San Diego Consolidated Gas & Electric Company for service. The connected load is equal to about 1400 16 candlepower equivalents.

LOS ANGELES, CAL.—Board of Supervisors passed an ordinance granting G. S. Forney a franchise to operate a system of gas pipes in the following district: All public roads and highways in township 1 north, range 10 w.; township 1 north, range 11 west, and township 1 south, range 10 west and township 1 south, range 11 west, S. B. B. and M.

GRANGEVILLE, IDAHO.—The Big Bend Electric Light & Power Company, which recently purchased the plant of the Grangeville Light & Power Company, has taken possession. Eugene Enloo of Spokane is the manager, and announces that his company will spend, within the next three months, about $50,000, enlarging and improving the plant and extending the service lines to Cottonwood.

SAN FRANCISCO, CAL.—City Attorney Long has advised the Supervisors that the city has the legal power to erect an electric light plant in Golden Gate Park to light the park and that such power must be exercised by the Park Commissioners in the absence of an ordinance granting such power to the Board of Works. He holds that the plant cannot be used for the purpose of furnishing light to the surrounding districts.

RED BLUFF, CAL.—The transfers of 12 United States patents for land from the Southern Pacific to H. A. Kluegel, and by him to J. W. Goodwin here gives reason for the opinion that another power company will exploit Tehama county. The deeds transfers 680 acres of land on Mill Creek, 20 miles southeast of this city. Goodwin is president and a heavy stockholder in the Oro Water, Light & Power Company, which has a power plant in Butte county, north of Oroville, and contemplates the construction of a plant at Humbug Valley, in Plumas county.

LOS ANGELES, CAL.—When the application for a receiver for the San Bernardino Valley Gas Company came before Judge Wellborn it was found that a petition had been filed by 80 per cent of the creditors, including holders of loans and securities, asking that a receiver be not appointed. It is declared that the company has an income of $20,000 a month and is solvent. A few days ago a conference of the largest creditors and the officials of the company was held, and it was unanimously agreed that the best interests of all demanded that the petition for a receiver be opposed and defeated if possible. The business is claimed to be on a paying basis.

SALT LAKE CITY, UTAH.—Announcement is officially made by President William H. Bancroft that contracts have been let to Westinghouse, Church, Kerr & Co. of New York for the 11,000 h.p. reserve station for the Utah Light & Railway Company. It will be located on the Jordan river, near the company's present transformer station and steam plant, and work is already under way on the preliminaries. The cost will be between $600,000 and $750,000. The plant will be installed for the purpose of providing an absolutely continuous supply of electricity for lighting, power and street railway operations in Salt Lake and Ogden.

SAN BERNARDINO, CAL.—The bankruptcy proceedings which were two weeks ago commenced against the San Bernardino Valley Gas Company, will probably be called off by the court because of the strong showing that was made in the answer to the complaint. The law provides that bankruptcy proceedings may at any time be defeated by an intervenor signed by a certain percentage of creditors and the strong showing made in this line it is thought will weigh heavily with the court in arriving at a decision. The bankruptcy proceedings were brought by Redlands interests which have not seemed to be satisfied with the status of the business, the action being brought against the advice of bankers in all the cities of the valley who felt that the business would be in far better shape if allowed to work its own way out.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Company let a contract this week to R. D. Wood & Co., of Philadelphia, for a 5,000,000 cubic foot gas holder having a diameter of 195 feet and a height of 188 feet. The steel work will all be rolled punched in Philadelphia, and shipments by railroad will commence immediately, as there will be 2635 tons of steel for transportation. Meanwhile the company will put a large force of men at work preparing the foundations for this tank. The actual work of erecting the steel structure will begin August 15, with 350 men handling the steel sheets. The construction work upon the holder will keep this force at work for months but the engineers expect to have the holder completed and ready to receive gas by April 10, 1911. The holder will be built in the Potrero adjoining the present gas works.

PORTLAND, ORE.—The Portland Gas & Coke Company has elected the following new board of directors: C. F. Adams, chairman; H. L. Corbett, Guy W. Talbot, T. Scott Brooke, W. W. Cotton, R. L. Sabin of Portland; S. Z. Mitchell, F. G. Sykes and E. W. Hill of New York. The officers of the company are Guy W. Talbot, president; Geo. F. Nevins, secretary and treasurer; M. H. Arning of New York, assistant secretary and treasurer, and H. M. Papst, general manager. The Northwest Gas Equipment Company has disposed of its retail holdings in Portland to the Portland Gas & Coke Company, which has not been in the appliance business for some

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years. The Portland Gas & Coke Company will handle the retail field again, and the Northwest Gas Equipment Company will do a Pacific Coast wholesale trade only, with headquarters at 506 Lewis Building, Portland. W. M. Kapus is president and manager and Lewis A. McArthur secretary and treasurer.

LOS ANGELES, CAL.—The Los Angeles Gas and Electric Company has brought suit against the city of Los Angeles in the Superior Court to recover $23,884.80, paid as taxes on the franchise and personal property of the corporation. The assessment made by the county assessor last year on the property was as follows: Gas pipes, meters and distributing system, $234,000; electric regulators, $1,120,000; electric overhead distribution system (annex 1896) $84,000; electric overhead system (annex 1899) $11,000; electric underground system, $105,000; gas works plant, $890,000; electric works plant, $410,000; franchise to use the public highways of the city of Los Angeles for the introduction into and supplying the city and its inhabitants gas light and other illuminating light, $906,100. The prayer of the petition is that the assessment and tax upon the property of the plaintiff be set aside in toto, and if not in toto, as to any amount in excess of the valuation of $200,000, and a tax of $3234.

KLAMATH FALLS, ORE.—C. S. and R. S. Moore, capitalists of this city, have purchased the interests of Alex Martin Sr., H. V. Gates and E. R. Reames in the Klamath Light & Power Company and have secured control of all the available power rights on Link river, the stream that drains Upper Klamath Lake. The Moore Bros. already owned a valuable power plant on the west side of the river, and with the one which they have just purchased and which supplied the city of Klamath Falls with light and electric power they now have a monopoly of that line of business. The plant which the Moores own on the west bank of the river supplies electricity for Bonanza, Midland and Merrill. The plant which they just purchased and which suppplied the city of Klamath Falls was inadequate to the requirements made upon it, especially in the winter months and after the mills have begun to grind wheat. By combining the two plants it will be possible to utilize the surplus power which has heretofore been useless, and at the same time provide the city with a better service.

TELEPHONE AND TELEGRAPH.

ELY, NEV.—The White Pine Telephone Company contemplates expending $15,000 in improving its service in the district.

RED BLUFF, CAL.—Joe Tait has been granted a franchise to establish and maintain a telephone system in the town of Red Bluff.

DUNSMUIR, CAL.—The Southern Pacific is installing telephones in several stations between this point and Red Bluff with a view of operating trains by telephone. For some time the trains between Dunsmuir and Ashland have been operated by telephone. The sending of train orders on this division has proved very successful and the same system on several Eastern roads has been successful beyond all anticipations. The telephone system on railroads does not do away with the telegraph but supplements it.

WATERWORKS.

OAKLAND, CAL.—More than $5,000,000 will be spent by the Bay Cities Water Company in installing distributing systems in Oakland, Berkeley, Alameda and Piedmont, according to Engineer C. L. Gilman, who states that the plans of the water company were so far completed that work could be commenced on the distributing systems within 48 hours after orders had been received by section chiefs. Gilman declared that by the addition of large cross mains to the regular main system, and fire protection of the best kind could be given for an increase of 50 per cent in population, and which would be ample for the supply of the East Bay cities for many years to come. His figures for the distributing systems for the four East Bay cities follow: Oakland, $4,250,000; Berkeley, $650,000; Piedmont, $200,000 and Alameda, $450,000. This figure for the Alameda system is for the company's plan of distribution. The $830,000 called for by Water Expert Bannister in his estimate is for an elaborate system of cross mains. In 18 months from the day the first spade full of earth is thrown to the surface, Gilman says the Bay Cities Water Company will have its Mount Hamilton supply in Oakland, Berkeley, Piedmont and Alameda.

SAN FRANCISCO, CAL.—The shipping interests of San Francisco are protesting against the water charges at this port. It is declared that the Spring Valley Company, through excessive rates, imposes an annual unnecessary tax of more than $100,000 on the shipping of the harbor. The result naturally is to drive the sea carrying trade from San Francisco. The benefits of public docks are nullified. Water that may be purchased for 16c the 1000 gallons in East street costs $1.50 at ship's side a few feet distant. It is to remedy this state of affairs that the ship owners have protested to the Supervisors. Although its established harbor rate is $1.50 per 1000 gallons, Spring Valley sells its water to shipping companies with less regard to value than to what it can get. While many companies pay the full rate some concerns pay $1.25 per 1000 gallons, others 75c and the Southern Pacific only 16c. The condition has become so grave that the Pacific Coast Steamship Company announces that it will go into the water business on its own account and effect a big saving unless the price is cut. Even as it is, the shipping men are willing to pay as high as 32c per 1000 gallons. The Harbor Commissioners have for some time had the matter under consideration. President Walter V. Stafford has collected data which demonstrates the difficulties under which local ship owners labor. He has just been informed that the rate at San Pedro, a rival port, has been cut to 25c.

NEW CATALOGUES.

In Bulletin No. 4741, recently issued by the General Electric Company, Luminous Arc Lamps for Multiple Circuits are illustrated and described.

High Vacuum Surface Condensers for Steam Turbines are illustrated and described in Bulletin 106 from the Wheeler Condenser and Engineering Company of Carteret, N. J.

"Curtis Turbine Installations" is the title of an attractive publication recently issued by the General Electric Company and containing fifty illustrations of installations of Curtis steam turbine-generators of various capacities. The number of this publication is 4732.

In Bulletin No. 4736, entitled "Lightning Arresters," recently issued by the General Electric Company, are described various types of arresters for alternating and direct current, high and low voltage circuits. These arresters are described and illustrated in considerable detail.

Pulletin No. 4742, entitled "Electric Drive in Grain Elevators and Flour Mills," recently issued by the General Electric Company, describes in considerable detail the application of the induction motor to this work, and contains illustrations of a number of installations in various grain elevators and flour mills.

Line Drop Compensators for Circuits are illustrated and described in Bulletin No. 4740, issued by the General Electric Company. This compensator can be applied to switchboards already installed without any radical changes in the existing panels and can be mounted at any convenient place behind the panel or on the wall, the small leads only being brought to the instrument on the panel.

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Portland, Couch Bldg.

Southern Pacific Co. 14
San Francisco, Flood Bldg.

Sprague Electric Co. 2
New York City, 527-531 W. 34th.
San Francisco, Atlas Bldg.
Seattle, Colman Bldg.

Standard Und. Cable Co. 1
San Francisco, First National Bank Bldg.
Los Angeles, Union Trust Bldg.
Seattle Office, Lowman Bldg.

Star Expansion Bolt Co. 4
New York City, 147-149 Cedar.

Sterling Paint Company, ... 11
San Francisco, 118 First.

Swayne, R. B. 9
San Francisco, 813 Postal Telegraph Bldg.

T

Technical Book Shop 4
San Francisco, 604 Mission.

Tel. & Elec. Equip. Co. .....
San Francisco, 612 Howard.
Los Angeles, Security Bdg.
Seattle, Alaska Bldg.
Portland, Couch Bldg.

Thomas and Sons Co., R. .....
New York, 227 Fulton.
East Liverpool, Ohio.

Tracy Engineering Co. 9
San Francisco, 461 Market.
Los Angeles, Central Bldg.

V

Vulcan Electric Heating Co. 13
Chicago, 545 W. Jackson Blvd.

Vulcan Iron Works 1
San Francisco, 604 Mission.

W

Western Electric Co. 3
San Francisco, 680 Folsom.
Oakland, 507 16th.
Los Angeles, 119 E. 7th
Seattle, 1518 First Ave. So.

Western Wireless Equipment Co. .. 4
San Francisco, Grant Bldg, 7th and Market.

Westinghouse. Elec. & Mfg. Co. ... 6
Pittsburg, Pa.
Los Angeles, 527 So. Main.
Denver, 429 17th.
Seattle, Central Bldg.
Salt Lake City, 212-214 So. W. Temple.
San Francisco, 165 2d.
Spokane, Columbia Bldg.
Portland, Couch Bldg.
Butte, Lewisohn Bldg.
Canada, Canadian-Westinghouse Co., Ltd., Hamilton, Ontario.
Mexico. G. & O., Braniff & Co., City of Mexico.

Westinghouse Machine Co. 6
Pittsburg, Pa.
San Francisco, 141 Second.

Weston Elect'l. Instrument Co. 14
Waverly Park, N. J.
New York, 114 Liberty.
San Francisco, 682-684 Mission.

Wilbur, G. A. 11
San Francisco, 61 Second.